Applying and advancing established and emergent concepts used in studies of recreational fishers: the case of the Tasmanian game fishery

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Statement of originality

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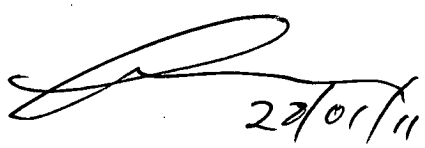

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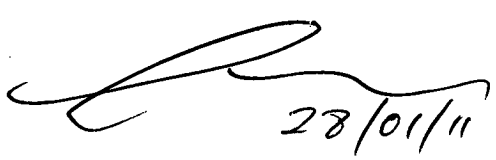

Sven Frijlink

Dedication

This dissertation is dedicated to my late sister, Elke, who passed away prior to me commencing my PhD. I reckon she would have been proud.

TABLE OF CONTENTS

List of Tables

Chapter 4

Chapter 5

List of Figures

Abstract

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The overarching aim of this dissertation was to augment emerging areas of research on human dimensions of recreational fisheries through socioeconomic studies of Tasmanian game fishers. A secondary objective was to develop an advanced understanding of Tasmanian game fishers in order to inform the management of the fishery. Largely quantitative socioeconomic data were collected through two mail questionnaires, a telephone administered diary survey and a 'supplementary' telephone survey. The study specifically addressed four areas of research. First, heterogeneity among fishers was explored according to anglers' levels of recreational specialisation by developing an index measuring three specialisation sub-dimensions – behaviour, commitment and skills and knowledge. Three specialisation groups were identified using cluster analysis and compared using standard statistical techniques. Anglers' levels of specialisation were significantly related to mode of fishery access, income, fishing club membership, species preference, conservation orientation, activity-specific and activity-general motivations, attitudes to catching large/trophy fish and attitudes to catching particular types of fish. Second, socioeconomic characteristics were compared between private boat and charter boat fishers using standard statistical techniques. Applying specialisation results as a 'filter', significant differences between the two groups were classified as either specialisation-mediated or specialisation-independent. Included in the former were income and fishing club membership; the latter consisted of age, frequency of fishing with family based groups, activity-general motivations, attitudes to catching large fish and many fish, and attitudes to management. Angling groups also differed according to time spent on fishing trips, educational and employment status,

catch history and non-game fishing activity; however, no reference to specialisation was determined. Third, building on the work of Sutton (2001), the effects of personal and situational variables on voluntary fish release behaviour were explored using logistic regression analyses. For private and charter boat fishers, the odds of voluntarily releasing a fish were positively related to the skills and knowledge dimension of specialisation, the number of fish caught on a trip and prior fishing activity during a fishing season. For private boat fishers, significant predictors included avidity, attitudes to catching fish and tournament participation. Situational variables had a higher predictive capacity than personal variables. Fourth, an iterative bidding contingent valuation methodology was employed to determine whether resource valuation ascribed by private boat fishers was influenced by harvest orientation and/or by sub-dimensions of specialisation. Using multiple linear regression models, fishers' willingness to pay (above what they had already spent) for seasonal fishery access was significantly related to avidity, income, the number of fish caught during the season and fishers' levels of agreement with promoting catch and release fishing. Finally, various implications of the results for the management of the fisheries were discussed, and future research needs were identified.

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at the Fifth World recreational Fishing Conference in Fort Lauderdale, Florida.

Acronyms and Abbreviations

ABARE	Australian Bureau of Agricultural and Resource Economics
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
BRS	Bureau of Rural Sciences
CBO	Charter Boat Operators
CBOAT	Charter Boat Operators Association of Tasmania
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
DPIPWE	Department of Primary Industries, Parks, Water and Environment
EBFM	Ecosystem Based Fisheries Management
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999
ESD	Ecologically Sustainable Development
ESF	Eastern Skipjack Tuna Fishery
ETBF	Eastern Tuna and Billfish Fishery
FMA Act	*Fisheries Management Act* 1992
IPOA-Sharks	International Plan of Action for the Conservation and Management of Sharks
ITQ	Individual Transferable Quotas
MAST	Marine and Safety Tasmania
NOAA	National Oceans and Atmospheric Administration
NPAS	National Plan of Action for Sharks
OCS	Offshore Constitutional Settlement
RecFAC	Recreational Fisheries Advisory Committee
RECFISH	Australian Recreational and Sport Fishing Industry Confederation Inc
RMFO	Regional Fisheries Management Organisation
SBT	Southern Bluefin Tuna
SBTMAC	Southern Bluefin Tuna Management Advisory Committee
SCBOOT	Sea Charter Boat Operators of Tasmania
SENTF	South East Non-Trawl Fishery

SSF	Southern Shark Fishery
TAC	Total Allowable Catch
TAFI	Tasmanian Aquaculture and Fisheries Institute
TARFish	Tasmanian Association for Recreational Fishing
TGFA	Tasmanian Game Fishing Association
The Code	Code of Conduct for Responsible Fisheries
The Convention	The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
UNCLOS	United Nations Convention on the Law of the Sea
UN-FAO	United Nations Food and Agriculture Organisation
UNFSA	United Nations Fish Stocks Agreement
WCPFC	Western and Central Pacific Fisheries Commission
WSF	Western Skipjack Tuna Fishery
WTBF	Western Tuna and Billfish Fishery

CHAPTER 1

Introduction

1.1 The value and application of socio-economic research in recreational fisheries management

There is a growing recognition that the management of recreational fisheries is not limited to the biological and ecological stewardship of fish populations. Social scientists, and increasingly fisheries managers, recognise the term "fishery" to also refer to a social system that includes fishers, governments and those involved with support infrastructure and related industries (Ditton, 2001). According to Neilson (1993), fisheries comprise three common elements: the aquatic organism/s of interest, the environment in which they live and the people who pursue them.

Studies advocating a human dimensions approach to complement traditional fisheries management date back to the 1940s (i.e. Holmes, 1946; King, 1948; Hunter, 1949). Since then, there has been growing recognition amongst fisheries managers of the need to better understand the social and economic dimensions of recreational fisheries. As pressures on fisheries from extractive users intensify, this type of information becomes salient in addressing the increasing disquiet over resource allocation and rights of access between competing stakeholders. Conflicting interests are not confined to recreational and commercial fisheries; numerous studies suggest that sub-populations within recreational fisheries differ markedly in their resource requirements. As such, a comprehensive understanding of anglers' values, attitudes, expectations, motivations, and consumptive behaviour will better equip managers to maximise community benefits from fisheries resources and allocate management resources more effectively.

Many factors are implicated in the developing role of social and economic information in the management of recreational fisheries. While proximate

factors are many and fishery dependent, the recognition of rapidly accelerating demands on fisheries resources is an overarching factor requiring greater collaboration between resource managers and fishers, and a greater emphasis on maximising benefits in ways that distribute resources more equitably. In doing so, the decision making process is enriched by considering a wider suite of parameters including the impact that fishers have on the resource, their consumptive focus, the social value received from fishing, how fishers perceive and navigate limits to their participation (i.e. rules and regulations), and their economic contributions to regional economies. The increasing recognition that recreational fisheries can significantly deplete fish stocks in a manner comparable with commercial fisheries (McPhee *et al.* 2002; Cooke and Cowx, 2004; Arlinghaus and Cooke, 2005; Lewin *et al.* 2006) underscores the need to better understand recreational fishers in order to better manage the resource.

Other factors contributing to the growing role of human dimensions research in recreational angling management include developments in disciplines such as economics, sociology, leisure sciences, geography and psychology. Such developments have allowed the benefits that participants and communities receive from recreational participation to be demonstrated more effectively. For example, the development of non-market valuation techniques has permitted the economic valuation of anglers' access to fishery resources in a manner that facilitates comparisons between recreational and commercial fishers, and between angling sub-populations targeting the same species. The development of interdisciplinary approaches to natural resource management has enabled disciplinary developments to be incorporated within traditional approaches to fisheries management. Furthermore, an increasing number of management authorities are reliant upon angler licence fees to fund management costs, fostering an approach to management whereby fishers may be viewed as consumers and management agencies as service providers. As service providers, managers are obliged to attend to the expectations and orientations of stakeholders.

1.1.1 Exploring diversity within recreational fishing populations

There is growing recognition that populations of recreational fishers are not homogeneous assemblages. Therefore, management activities guided by average values from aggregated socioeconomic data will obscure diversity within angling populations and lead to outcomes unlikely to maximise satisfaction amongst fishers. Hahn (1991: 380) contends that "the most basic, serious, and repeated error made by fisheries personnel in conducting angler research and in formulating fisheries policies is to assume that anglers constitute a homogenous group". Studies designed to explore diversity within angling populations generally identify heterogeneous groups of individuals with different values, behaviours, attitudes and resource requirements which can be addressed by the management framework to allocate resources more effectively, maximise acceptance of and compliance with regulations, and better predict how different sub-groups will be differentially impacted by allocation measures or fishing regulations. Programs designed to disseminate information may also be conducted more effectively by identifying and targeting groups differentially.

Various methodologies have been applied to explore diversity within fishing populations. The methodology chosen is largely guided by the objectives underpinning the research, the existence of discernable subpopulations, and in consideration of the capacity of management agencies to utilise the results. Numerous researchers have applied means of identifying sub-populations, such as cluster analysis, to discern sub-groups to create typologies according to the variable/s of interest. Other studies have compared apparent and managerially relevant sub-populations within recreational fisheries based on criteria such as the type of water fished, fishing mode employed, species targeted, and whether or not fishers participate in tournaments or are affiliated with angling clubs and associations.

In the current study, three criteria are used to explore diversity among Tasmanian game fishers: fishing mode, recreational specialisation and catch and release attitudes and behaviour. The approaches undertaken build on

existing studies that have examined diversity among fishers pertaining to these criteria. While the positioning of the current study in view of existing research will be detailed in individual chapter introductions, an overview of the value of research relating to each of these criteria is outlined below.

1.1.2 Fishing mode

In this study, two 'sectors' of game fishers are apparent; private boat fishers and charter boat fishers. The former refers to fishers who target game fish using private boats whilst the latter pay for the services of charter boat operators to target game fish, and often assist anglers in the capture process. To my knowledge, only one prior study has compared socioeconomic measures of fishers according to whether individuals fished from private or charter boats (Ditton *et al.* 1998). While comparing anglers of different modes was not the primary objective of their study, Ditton *et al.* (1998) observed numerous differences between private and charter boat fishers. In the current study, the recognition of two distinct and well defined 'sectors' has implications for applying different management foci to each sector if intrinsic differences are observed. The results may also have implications for other fisheries defined by the existence of private boat and charter boat sectors.

1.1.3 Recreational specialisation

In his seminal study of Wyoming trout anglers, Bryan (1977:p. 175) defined recreational specialisation as "a continuum of behaviour from the general to the particular, reflected by equipment and skills used and activity setting preferences". Bryan first applied the concept to segment the trout angling population into four different sub-groups: occasional anglers, generalists, technique specialists, and setting-technique specialists. Anglers were segmented according to their frequency of participation, setting preferences, equipment, the importance ascribed to catching fish, social setting, and management preferences. According to Bryan, highly specialised anglers (i.e. setting and technique specialists) are committed to fishing and use sophisticated techniques and equipment. Conversely, least specialised anglers

(occasional anglers) have little regard for the activity and do not show a discernable preference for equipment or technique.

Since its conceptualisation, the concept of recreational specialisation has gained increasing acceptance as a framework for understanding the multi-faceted nature of recreationist's behaviours, values and attitudes. It has also become an accepted means to assess populations of recreationists by segmenting the population into discrete and meaningful groups, often with management implications. Despite different approaches taken to measure and apply recreational specialisation, studies have consistently demonstrated differences between specialisation mediated sub-populations of anglers. Differences usually relate, but are not confined to, motivations, attitudes to management or to marine protected areas, equipment ownership and use, conservation concerns, resource dependency, non-market valuation, and fishing club membership.

Perhaps the most significant application of recreation specialisation is in relation to its effect on conservation attitudes and behaviours, and support for management (Oh and Ditton, 2006; 2008). Management approaches informed by knowledge of angler specialisation may assist in providing quality angling experiences for more participants while increasing support for fisheries management (Chipman and Helfrich, 1988; Fisher, 1997; Salz *et al.* 2001a; Oh and Ditton, 2006). According to Chipman and Helfrich (1998), the identification of angler sub-groups in relation to attitudes and behaviours can be used to develop diverse management strategies reflecting the needs and wants of different groups. Chipman and Helfrich (1988) further suggest that segmentation based on specialisation level is useful for understanding how rule or regulation changes have different impacts on different segments of the angling population, and can be useful for avoiding unexpected displacement of affected anglers.

1.1.4 Catch and release behaviour and attitudes

The practice of releasing angled fish alive to the water has gained popularity in many fisheries as a way of reducing impacts on fish populations whilst enjoying the experience of catching fish (Policanski, 2002; Arlinghaus, 2007). As such, staff in management agencies, recreational fishing organisations and fishing-based businesses (i.e. guides and charter boat operators) have increasingly been promoting the catch and release philosophy among anglers.

Due to the perceived value of catch and release fishing as a means of promoting resource conservation, a considerable volume of research has focussed on post-release health of angled fish. However, relatively little is understood about anglers within a catch and release context, and the reasons underpinning their decisions to release or retain fish. An understanding of these factors is fundamental in ensuring that the needs of these fishers are addressed. Furthermore, catch and release fishing is often promoted with little knowledge about how these efforts will be understood, accepted and practiced by anglers (Ditton and Fedler, 1989; Peyton and Gigliotti, 1989; Sutton, 2001). More effective promotional efforts directed towards anglers who are most likely to be receptive to catch and release fishing will require an understanding of attitudes, motivations and preferences of participants. Such an understanding should also enable greater accuracy in predicting future catch and release participation.

1.2 Objectives of research

On the basis of the foregoing, the overarching aim of this study is to examine the Tasmanian game fishery as a case study in which to explore the validity of established and emergent concepts and frameworks underpinning socioeconomic research on recreational fishing populations. A secondary objective is to develop a better understanding of Tasmanian game fishers to inform the management of the fishery. Specific sub-objectives particular to the four data chapters within this thesis are to:

1. evaluate the use of the recreational specialisation concept to explore heterogeneity among fishers in a small scale game fishery (Chapter 4);

2. to investigate the relative effectiveness of exploring diversity within a recreational fishing population according to both recreational specialisation and sectoral comparisons (Chapter 5);

3. to make a valuable contribution to the current understanding of factors influencing the catch and release behaviour of recreational fishers (Chapter 6); and

4. to determine the effect of anglers' harvest orientation and variables pertaining to recreational specialisation on the economic value ascribed to annual fishery access (Chapter 7).

1.3 Chapter preview

Chapter 2 provides context and background information relevant to the study. The Chapter consists of four sections: (1) the role of human dimensions research in Australian fisheries management; (2) management of game species that frequent Tasmanian waters; (3) overview of the Tasmanian game fishery; and (4) prior studies of Tasmanian game fishers. In the first section, the legislative requirements pertaining to the consideration of social and economic data in the management of Australian fisheries are explained. In particular, the adoption of Ecologically Sustainable Development (ESD) and Ecosystem Based Fisheries Management (EBFM) principles by Australian governments are outlined as they relate to fisheries management at a State and Federal level. In the second section, the management framework relating to game species caught in Tasmanian waters is described. As all species relevant to this study traverse national and international boundaries, the description extends to management agreements, treaties, and legislative jurisdictions, at State, Commonwealth and International levels. Section 3 describes the Tasmanian game fishery in terms of species caught and their seasonality,

distribution and relative abundance in Tasmanian waters. The two identified angling groups – private boat fishers and charter boat fishers – are also described in terms of their access to the fishery. In Section 4, six studies relating to the Tasmanian fishery are summarised and their relevance to the current study is outlined.

Chapter 3 outlines and provides justification for the methodological approaches undertaken to collect data for this study. While data analyses particular to individual objectives will be explained in the respective chapters, methods used to collect data span all chapters, justifying the incorporation of a separate methodological entity. In brief, a questionnaire was used to collect socioeconomic data from charter boat fishers that was distributed by charter boat operators at the end of fishing trips. For private boat fishers, similar data elements were also collected through a questionnaire. A sub-set of respondents was 'recruited' to participate in a telephone administered diary survey to collect detailed trip-related data. At the conclusion of the diary survey, respondents were invited to complete a detailed telephone interview to collect supplementary information to address issues relevant to the fishery.

In Chapter 4, an index was developed in accordance with data elements measuring the three components of recreational specialisation, as suggested by Scott and Shafer (2001) – commitment, behaviour and skills and knowledge. The index was then segmented using cluster analysis to identify discrete groups according to anglers' level of specialisation. Comparative analytical techniques were employed to determine whether specialisation groups of anglers differed according to a host of dependent variables. These variables related to mode of fishing, fishing club affiliation, demographics, species preference, social group participation, conservation orientation, motivations, consumptive orientation and management preferences.

In Chapter 5, a comparative analysis between private boat and charter boat fishers was undertaken in regard to the variables mentioned in the previous section. The observation in Chapter 4 that private boat fishers are, on average, more specialised than charter boat fishers allowed hypotheses to be

developed: If specialisation mediated differences were observed for a dependent variable in Chapter 4, significant differences between private boat and charter boat fishers were also hypothesised. In effect, this approach enabled the determination of whether significant differences between angler groups for a particular variable were specialisation-mediated or specialisation-independent.

Chapter 6 explores the effects of a suite of personal and situational variables on anglers catch and release behaviour. The study builds on Sutton's (2001) theoretical approach to understanding catch and release behaviour which assumes that decisions to keep or release caught fish are determined by a rational process in which relevant personal and situational factors are evaluated. Personal variables considered pertain to five categories: specialisation, demography, consumptive orientation, conservation orientation and attitudes to catch and release fishing. Situational variables used were the number of fish caught, prior fishing activity and whether or not fish were caught as part of a fishing tournament. Catch and release behaviour was measured using a dichotomous variable that distinguished fishing trips in which no fish were voluntarily released from trips where at least one fish was voluntarily released.

Chapter 7 reports on an iterative bidding contingent valuation methodology used to determine whether resource valuation ascribed by private boat game fishers was influenced by specific sub-dimensions of recreational specialisation and/or by their harvest orientation. Fishers were asked about their willingness to pay (above what they had already spent) to go fishing as often as they had during the 2007 season. The decision to use specialisation related measures as predictor variables builds on work by Oh *et al.* (2005) and Oh and Ditton (2008), who observed a positive relationship between willingness to pay and specialisation indices. To understand the relationship better, Oh *et al.* (2005) suggested that future studies examine the relationship between willingness to pay and constituent variables representing sub-dimensions of specialisation. Anglers' harvest orientation was measured by catch and release behaviour and by attitudes to catch and release fishing. In

regard to the former, the potential value of the results was perceived to lie in the economic efficiency of resource utilisation: releasing fish may be seen as a more efficient use of resources as released fish may provide valuable fishing experiences for successive anglers who may, in turn, choose to harvest or release the same fish. As for catch and release attitudes, their value was perceived to lie in their ability to predict behaviour.

Chapter 8 comprises two sections. First, results from the study were discussed in reference to their contribution to existing research. As specific contributions were outlined in the data chapters, the Discussion focuses on contributions perceived to be most significant, and/or relevant to more than one of the four studies in the dissertation. Overarching issues relating to the methodologies used were discussed and, where appropriate, further research agendas were identified. In the second section, the relevance of the results to the management of the Tasmanian game fishery was discussed in reference to four apparent and/or emerging issues facing the fishery – increasing pressure on fish stocks, the implementation of EBFM principles, post-release survival of game fish and anticipated climate change mediated effects on game fish distribution and abundance. Where appropriate, future research suggestions were identified.

1.4 Study limitations

In Chapter Three, the sampling methodologies used to collect data for this study were outlined. For reasons explained in Chapter Three, the manner in which data were collected among both private boat fishers and charter boat fishers introduced potential biases – both sampling and non-response biases. For private boat fishers, questionnaires were distributed to boat owners only. Accordingly, private boat fishers who did not own their own boats were not included in this study. The lack of a sampling frame for this group made it furthermore impossible to determine whether non-response biases were also introduced. In other words, it is not clear whether the respondent group was representational of all of the eligible (i.e. game fishers) persons to whom the questionnaire was distributed. However, various authors have observed that

people with a high level of interest in the subject matter of a survey are more likely to respond (Brown *et al.* 1981; Choi *et al.* 1992; Fisher, 1997). This insight suggests that the response to this survey would probably be biased towards more specialised private boat fishers.

In regard to charter boat fishers, non-response effects may have also introduced biases within the dataset. Again, any biases imparted would probably be toward more specialised fishers. For reasons explained in Chapter Three, non-response rates could not be determined with a high degree of precision. Therefore, the extent of non-response effects, if evident, is unknown. Furthermore, the highly variable rates of questionnaire distribution among charter boat operators likely introduce sampling bias effects. It appears that for many charter boat operators, questionnaires were only distributed on a limited number of trips. Accordingly, the chances of receiving a questionnaire would have increased for more avid fishers. The probable effects of sampling bias in under-representing less avid individuals has also been recognized by other authors (Salz *et al.* 2001; Oh *et al.* 2005; Salz and Loomis, 2005).

The implications for these potential bias effects are discussed in relevant chapters. Furthermore, further research recommendations to address such biases in future studies are outlined in Section 8.1.1.

CHAPTER 2

Overview and Context

2.1 The role of human dimensions research in Australian fisheries management

Legislative and policy developments over recent decades have increased the profile of social and economic data in the decision making processes of Australian fisheries management authorities. The most notable developments facilitating changes in the regulatory system has been the adoption of Ecologically Sustainable Development (ESD) and Ecosystem Based Management (EBM) by Australian governments. The implications of both for Australian fisheries management are discussed below.

2.1.1 Ecologically Sustainable Development (ESD)

In 1992, all levels of Australian government agreed to adhere to the objectives and principles of the *National Strategy for Ecologically Sustainable Development* (NSESD) in the management of natural resources. The definition of ESD, as accepted by all Australian governments is:

Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased (Commonwealth of Australia, 1992: 6).

The concept of ESD is now the cornerstone of natural resource management in Australia and fosters the integration of economic, social and environmental considerations into the decision-making processes of governments and industry. The implications for fisheries management are considerable. Implementing ESD means that fisheries (and wildlife) managers need to consider not only the effects on the target species, but also the rest of the ecosystem. In addition to biological and ecological concerns, the Strategy stresses the need to:

consider, in an integrated way, the wider economic, social and environmental implications of our decisions and actions for Australia, the international community and the biosphere (Commonwealth of Australia, 1992: 6).

Therefore, managers need to recognise the relationship between the economic and social well-being of fishers (such as the profits to commercial fishers or the satisfaction of recreational fishers) and resource sustainability. Furthermore, the adoption of ESD prescribes community consultation and collaboration in the management of fisheries.

2.1.2 Ecosystem Based Fisheries Management

Ecosystem Based Fisheries Management (EBFM) is a new direction in fishery management focussing on the management of ecosystems rather than traditional single species approaches. This approach includes managing the impacts of fishing on target species as well as by-product and by-catch species, threatened, endangered and protected species, habitats and communities. While EBFM is still being conceptualised and adapted to existing management paradigms, there is a general understanding that EBFM must also consider the likely social and economic implications of fishing activities due to the recognition that humans are an integral component of the ecosystems in which fishing occurs, and is reflected in the range of definitions developed to encapsulate EBFM (see Marasco *et al.* {2007} for an overview of commonly used EBFM definitions). In view of these definitions, Marasco *et al.* (2007: 930) developed the definition of EBFM as a management system that:

recognises the physical, biological, economic and social interactions among the affected components of the ecosystem and attempts to manage fisheries to achieve a stipulated spectrum of societal goals, some of which may be in competition.

The United Nations Food and Agricultural Organisation (UN-FAO) provides five principles by which EBFM should adhere to (FAO, 2003). Of relevance to this study, the fifth principle states that "governance arrangements should ensure human and ecosystem well-being and equity".

In practical terms, EBFM is being adopted in Australia as an incremental extension of existing fisheries management approaches. Effectively, EBFM provides fisheries managers with a conceptual framework to address ESD principles: Fletcher (2006) considers EBFM to be both a sub-set of ESD and an operational mechanism to facilitate management progress of ESD. This view is consistent with the description of EBFM in the context of Australian fisheries management as "more evolutionary than revolutionary, with the revolution occurring with the mainstream incorporation of ESD" (McPhee, 2009: 212). Consonant too are the legislative requirements enabling EBFM, which were largely instituted by incorporating ESD principles into statute and policy (Scandol *et al.* 2005). Due to the emerging nature of EBFM, it is likely that the legislative framework, at state, national and international levels, will be modified to incorporate the operational requirements of further EBFM developments. Tallis *et al.* (2010) suggest that scientists and resource managers are struggling to develop policies to transcend EBFM from a theoretical framework to a management framework. Nonetheless, at the time of writing, legislation facilitating the four key operational tools of EBFM identified by the Australian Fisheries Management Authority (AFMA) – ecological risk assessments, improved data collection, by-catch reduction incentives and improved communication – were already in place. In the following section, key statutes and policies that have been informed by ESD and EBFM developments to consider human dimensions information into the management of Tasmanian game species are outlined.

2.1.3 Legislation and policy

In Tasmania, the *Living Marine Resources Management Act 1995* provides for the management of recreational fisheries and requires compliance with ESD principles in the formulation of policy and regulations. In particular, Schedule

1 of the Act emphasises the need to "promote the sustainable development of natural and physical resources". The phrase "sustainable development" is subsequently defined in the Act as "managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural well-being".

The *National Recreational Fishing Policy 1994*[1], which prescribes the management of Australian recreational fisheries, is also guided by ESD goals and principles with implications for the inclusion of social and economic data in the decision-making process. Of greatest relevance are Principles 13 and 14. The former states that "the economic, educational, health and other social benefits of recreational fishing should be widely recognized and actively promoted". The latter states that "fisheries management decisions should be based on sound information including fish biology, fishing activity, catches, and the economic and social values of recreational fishing".

At the federal or national level, the Commonwealth *Fisheries Management Act 1992* (FMA Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) direct the AFMA to manage commercial fisheries pursuant to ESD principles. While both pieces of legislation were enacted prior to the 'conscious' incorporation of EBFM in to Australian fisheries management, both are nonetheless consistent with EBFM: The FMA Act incorporates explicit references to wider ecological impacts of fishing, and the EPBC Act assesses fisheries against environmental standards. Furthermore, *Australia's Ocean Policy* adopts an explicit ecosystem-based approach to management, with specific requirements for regional ocean planning for related activities and stakeholders.

At an international level, the *Code of Conduct for Responsible Fisheries* makes many references to the consideration of social and economic factors in

[1] A new Policy was being drafted at the time of writing

the management of fisheries, both commercial and recreational. Perhaps most relevant is the following objective relating to fisheries research in Article 12:

States should recognize that responsible fisheries management requires the availability of a sound scientific basis to assist fisheries managers and other interested parties in making decisions. Therefore, States should ensure that appropriate research is conducted into all aspects of fisheries including biology, ecology, technology, environmental science, economics, social science, aquaculture and nutritional science.

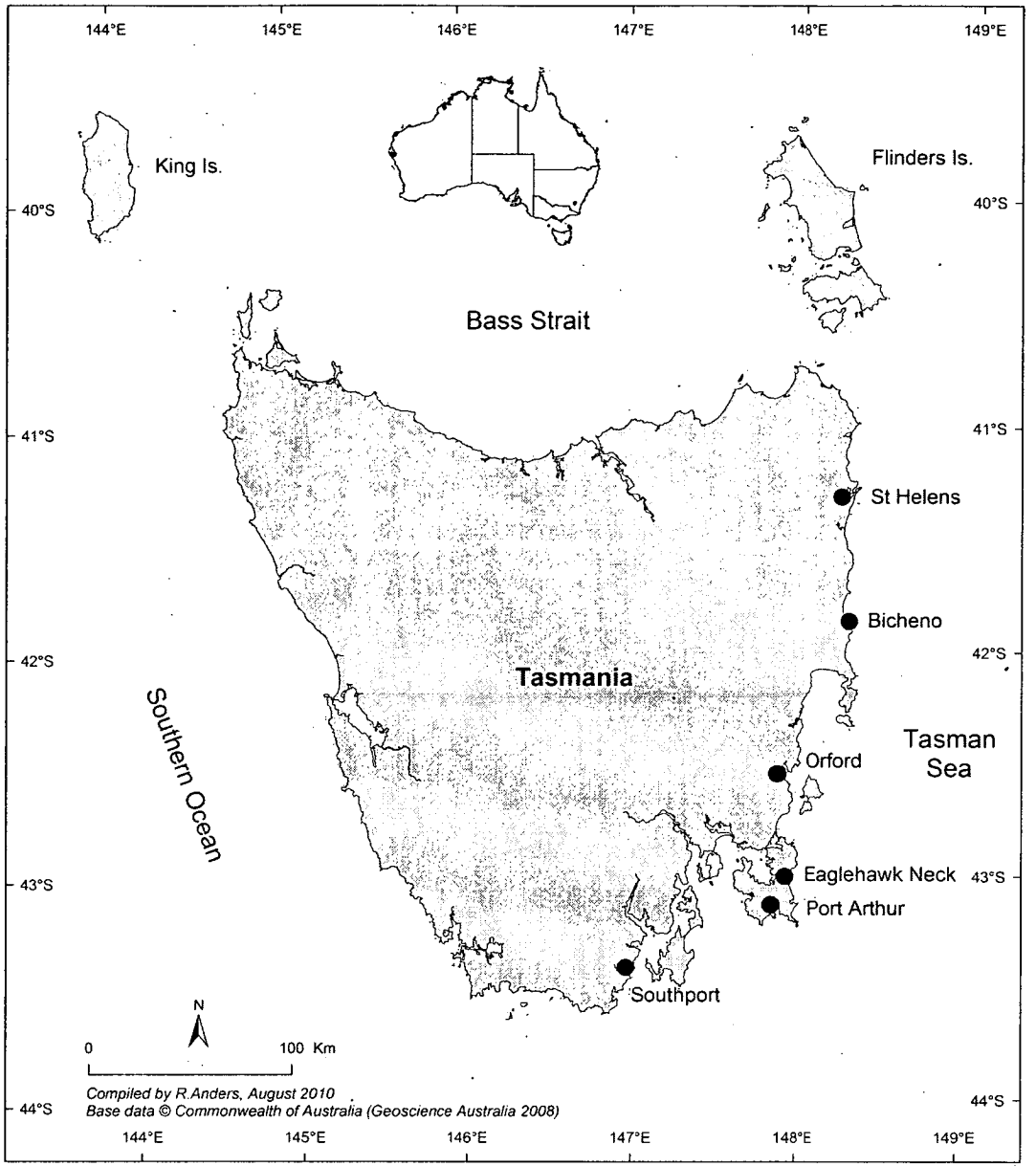
2.2 Overview of the Tasmanian game fishery

The Tasmanian recreational game fishery is based on a variety of species that utilise the warm waters of the Eastern Australian Current off the east and south-east coasts of Tasmania. Four main species of tuna (southern bluefin or SBT, yellowfin, albacore and striped tuna), two species of pelagic shark (mako and blue whaler shark) and, to a lesser extent, striped marlin occur in Tasmanian waters[2].

There is a high degree of inter-seasonal variability in the distribution and abundance of most game species (Morton and Lyle, 2003). Whilst the game fishing season generally commences in January, peak activity for all species except SBT generally occurs from February to April (Morton and Lyle, 2003). This peak coincides with warmer waters of the Eastern Australian Current pushing southward along Tasmania's east coast. SBT, which are regarded as Tasmania's iconic game species, prefer cooler waters, and are generally caught between April and June.

The two most popular places to access the fishery are St Helens, in Tasmania's north-east, and Eaglehawk Neck, on the Tasman Peninsula, in the south-east of the state (see Figure 2.1). Though less prominent, game fishers

[2] Other game species occasionally encountered off Tasmania are bigeye tuna (*Thunnus obesus*), slender tuna (*Allothunus fallai*), porbeagle shark (*Lamna nasus*), thresher shark (*Alopias vulpinus*), and swordfish (*Xiphias gladius*). However, the latter five species were not caught by survey respondents in this study and will not be referred to in this thesis.



2.1. Map of Tasmania illustrating the main access points for the recreational game fishery

also access the fishery from Flinders Island, Bicheno, Orford, Port Arthur and Southport. Pelagic sharks are also targeted in Bass Strait waters off Northern Tasmania. Traditionally, yellowfin tuna and striped marlin are targeted in northern waters off St Helens and Flinders Island; however anecdotal reports suggest that these species have been increasingly abundant in southern areas over recent years. SBT are generally targeted in southern waters from Eaglehawk Neck and Southport, though captures in northern waters are not

uncommon. The number of fishers accessing the fishery from Southport has increased considerably in recent years (Morton and Lyle, 2003; Forbes *et al.* 2009). Albacore tuna, striped tuna, mako shark and blue shark are generally distributed throughout the east coast.

2.2.1 Two 'types' of game fishers

The recreational fishery is characterised by two modes of access; by private boats and by charter boats. Fishers using private boat use trailer boats and motor cruisers that are sufficiently large and powerful to fish under oceanic conditions while charter boat fishers engage the services of charter boat operators to access fishing grounds. Charter boat businesses also provide clients with their expertise in locating and hooking fish, assistance in the capture process[3] and generally provide fishing equipment[4]. The Tasmanian charter boat fleet consists of boats from seven to 14 metres in length, the majority of which are past (or current) commercial fishing boats or fly-bridge cruisers. With the exception of one vessel, all charter boat operations charge customers on a trip basis and are licensed to carry from four to 10 passengers. One boat, which is technically a 'head boat' or 'party boat', charges a set fee per fisher, regardless of the number of fishers on the boat, and caters for a larger number of fishers[5]. Some charter boat operations also target non-game species, or cater for other activities (i.e. diving, sightseeing, whale watching), within and outside the game fishing season, while other businesses operate exclusively for game fishing charters.

The majority of both private boat and charter boat fishers target tuna by trolling surface or sub-surface lures. A small number also target tuna by trolling artificial flies or fish baits. Whilst striped marlin are occasionally caught when trolling for tuna, some anglers specifically target marlin by trolling a larger lure among an array of smaller lures used to attract tuna.

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[3] Often, charter boat operators will employ a deckhand to assist fishers in deploying lines and landing, handling and cleaning fish.

[4] From conversations with charter boat operators, it is estimated that only about 5% of clients supply their own fishing tackle (i.e. rods, reels, line, lures).

[5] The operator of this boat did not participate in the distribution of questionnaires in this study. See Chapter 3 for more information.

Mako and blue sharks are generally caught on trips where sharks are exclusively targeted using berley[6] and large baits. However, tuna and shark are sometimes targeted on the same trip[7].

2.3 Prior studies of Tasmanian game fishers

No previous studies have explicitly investigated the human dimensions of the Tasmanian game fishery. However, studies have been conducted to assess catch and effort (Morton and Lyle, 2003; Forbes *et al.* 2009), management implications for the charter boat industry (Smith, 1994: Evans, 1995), expenditure and economic value (Galeano *et al.* 2004) and community benefits of the St Helens charter boat industry (Brooks *et al.* 2001). While these studies do not directly address the socio-economic dimensions investigated in the current study, they provide valuable inferences and context and will be briefly discussed below.

Over the past decade, catch and effort studies have provided valuable information on the Tasmanian gamefish fishery. While limited information can be derived from general state-wide recreational fishing surveys conducted in 2000/01 (Lyle, 2005) and 2007/08 (Lyle *et al.* 2009), studies by Morton and Lyle (2003) and Forbes *et al.* (2009) collected data specific to the gamefish fishery. In particular, the latter two studies sought to better understand the impact of recreational fishing on SBT stocks in light of resource allocation issues that have arisen from Australia's participation as a member of the CCSBT. Together, the studies, which used a combination of intercept surveys and logbooks to collect data, validated anecdotal reports of considerable inter-seasonal variability in SBT captures: conservative seasonal harvest estimates by Morton and Lyle (2003) and Forbes *et al.* (2009) were 2.5 and 14.0 tonnes, respectively. Evans (1995) also highlighted the inter-seasonal variability between north-east and south-east Tasmanian with respect to fish abundance. Morton and Lyle (2003) and Forbes *et al.* (2009) also

[6] Berley (or chum), is a fish attracting solution generally composed of blood and offal.
[7] From conversations with private boat fishers, it appears that many of them carry tackle appropriate for catching sharks on their boat that is deployed when sharks are sighted. Mako sharks are often sighted when their dorsal fins protrude from the water's surface.

collected catch and effort data for all gamefish species caught. In terms of species prevalence, striped and albacore tuna were the most commonly caught species. Of direct relevance to the current study, Morton and Lyle (2003) and Forbes *et al.* (2009) reported fish retention rates[8] of approximately 80% for SBT, 86% for albacore tuna and 52% for striped tuna[9].

Coakes *et al.* (2001) and Galeano *et al* (2004) have addressed economic aspects of the Tasmanian game fishery. Coakes *et al.* (2001) used a qualitative approach to explore the contribution of the St Helens charter boat fishery to the St Helens community and economy. The study focused on both game and non-game charter activities in St Helens but recognised the predominance of game fishing among other fishing types. The study also recognised the contribution to the local economy through flow-on economic benefits and the role played by the game fishery in raising the tourist profile of the area. Galeano *et al.* (2004) conducted an economic survey of the charter and recreational game fishing sector along the east coast of Australia. In addition to collecting economic information relating to the charter, private boat and commercial sectors, Galeano *et al.* (2004) discussed how this information could be used in a resource allocation framework. For each of the eastern states, data pertaining to the number of fisher days, total annual trip-related expenses, and economic valuation of game fishing access were collected; some directly and some inferred from studies deemed to be comparable. Galeano *et al.* (2004) acknowledged that location specific valuation data would need to be collected before any robust efforts to reassess current allocation arrangements could be made. Nonetheless, the need to address this issue was underscored, with clear implications for all stakeholders in the ETBF. Of additional relevance to the current study was the assertion that resource sharing arrangements need to take into account the proportion of fish released by the recreational sector and the mortality rates of released fish. Furthermore, the study reported that Tasmanian charter boat operators were concerned about the future allocation of SBT.

[8] Retention rates did not distinguish between fish that released voluntarily or non-voluntarily (i.e. due to attaining species possession limits).
[9] Catch numbers for other gamefish species were to low for reliable retention estimates.

Smith (1994) conducted a study on the Tasmanian tuna charter fishery on behalf of the Tasmanian Department of Primary Industry and Fisheries to help resolve management issues identified within the fishery. Another objective of the report was to stimulate the then newly assembled industry representative body, the Charter Boat Operators Association of Tasmania (CBOAT) to make decisions to safeguard and strengthen the industry. Many recommendations from the report, which was written at a time when the management arrangements of the fishery were being considered between the Commonwealth and State Governments, have since been adopted. The study also provided estimates of charter income, participation and catches of SBT and yellowfin tuna over the 1993 season. Furthermore, Smith (1994) suggested that the recreational charter boat industry contained considerable scope for expansion. In recognition of the commercial SBT fishery also operating in Tasmanian waters, Smith suggested that such an expansion of the recreational fishery would probably increase benefits to the Tasmanian community.

2.4 Management of the game species caught in Tasmanian waters

To provide context for this study, it is helpful to understand how the fishery is managed, and therefore, how the resource is distributed between users. The management of game species that frequent Tasmanian waters falls into a number of management agreements, treaties, and legislative jurisdictions, at a State, Commonwealth and International level. While many of the arrangements are complex, especially for commercial fisheries, Offshore Constitutional Settlements (OCS) between the Commonwealth and the States have conferred management responsibility of commercial fisheries to the Commonwealth and the management of recreational fisheries to the States. These agreements recognise that game species transverse State/Commonwealth fishing zones, migrate between waters adjacent to different states, and extend to international waters beyond Australia's Fishing Zone (AFZ).

2.4.1 Commercial fisheries

Most management responsibilities of Commonwealth fisheries are undertaken by the Australian Fisheries Management Authority (AFMA) – Australia's central body for policy development, advice and coordination on national and international commercial fisheries management issues. The AFMA is a commission established in 1992 under the *Fisheries Administration Act 1991*. This legislation, coupled with the *Fisheries Management Act 1992* outlines the objectives, powers, functions and accountabilities of the AFMA. The objectives include providing efficient and cost effective management; maximizing economic efficiency of fisheries resources; accountability to the fishing industry and the broader community; achievement of government cost recovery targets; and, ensuring that the exploitation of fisheries resources is conducted in a manner pursuant to ESD principles.

Other legislation, such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Torres Strait Fisheries Act 1984*, provide further accountabilities. For example, the EPBC Act confers accountabilities relating to the assessment of fisheries against guidelines for ecological sustainability.

At a broader level, the AFMA has a responsibility to comply with any relevant international law, treaty or agreement to which Australia is a signatory. The Australian Government ratified the *United Nations Convention on the Law of the Sea* (UNCLOS) in 1982. As well as defining the area of the ocean that participating nations may exploit (through exclusive economic zones), the Convention provides a legal framework for the sustainable use of marine resources and pollution control. Australia has also ratified the *1995 United Nations Fish Stocks Agreement* (UNFSA). The Agreement is an elaboration of the provisions of UNCLOS for the conservation and management of straddling and highly migratory fish stocks. The agreement is binding for all 59 participating countries and establishes that management must be based on the best possible scientific information and the Precautionary Principle. It also fosters cooperation between countries and

promotes the optimum utilisation of fisheries resources both within and beyond the exclusive economic zones of participating countries.

Australia is also one of over 170 signatory countries to the UN Food and Agriculture Organisation's (UN-FAO) *Code of Conduct for Responsible Fisheries* in 1995. The Code, which consists of a collection of principles, goals and elements for action, is directed at both marine and freshwater systems, and is voluntary in nature. The mantra for the Code is "The right to fish carries with it the obligation to do so in a responsible manner so as to ensure effective conservation and management of the living aquatic resources." The Code was developed over a period of over 20 years by FAO members, the fishing industry, inter-governmental and non-governmental organizations. Governments, the fishing industry and other stakeholders have a responsibility to uphold the Code: the role of the FAO is to support it's activities but has no jurisdiction over the development and implementation of national fishing policies.

Australia is also a party to a number of multi-lateral Regional Fisheries Management Organisations (RMFOs) and fora concerned with the management of highly migratory, straddling and shared fish stocks. In relation to gamefish species that frequent Tasmanian waters, the Commission for the Conservation of the Southern Bluefin Tuna (CCSBT) and the Western and Central Pacific Fisheries Commission (WCPFC) are the most relevant. The role of these bodies is explained below in relation to individual species management.

Southern bluefin tuna

Australia's domestic southern bluefin tuna (*Thunnu maccoyi*) fishery is managed in accordance with Australia's obligations as a member of the CCSBT. The CCSBT was established under the *Convention for the Conservation of the Southern Bluefin Tuna* in 1994 due to concerns by Australia, Japan and New Zealand over the sustainability of SBT stocks. The CCSBT aims to promote the conservation and optimum utilisation of SBT through ongoing research and catch limits (quotas) that apply to member

countries. Since the inception of the CCSBT, Taiwan and Korea have also become members. South Africa, The Philippines and Indonesia, while not members, are also issued with nominal quota. A key current management objective of the CCSBT is to have restored the SBT population to stock levels in 1980 by 2020. However, recent stock assessments suggest that the chance of meeting this objective is very low.

The management arrangements for the domestic SBT fishery are outlined in the *Southern Bluefin Tuna Fishery Management Plan 1995*. The Plan prescribes the management of SBT using a system of Individual Transferrable Quotas (ITQs) for the commercial sector. The principal forum in which issues relating to the management, research and compliance in the domestic fishery are coordinated is the AFMA's Southern Bluefin Tuna Management Advisory Committee (SBTMAC).

Within the AFZ, the key areas where SBT have historically been caught are the Great Australian Bight and waters off south eastern Australia. Currently, 98% of Australia's SBT quota is taken off South Australia by the purse-seine fishery. These fish are towed to sea cages near Port Lincoln and 'fattened up' before being harvested and exported to Japan for the lucrative sashimi market. The remaining 2% of the quota is taken by pole and line fishers, trolling, and as by-product (retained by-catch) by long-line vessels in southern Australian waters, including around south-eastern Tasmania.

Albacore tuna, yellowfin tuna, bigeye tuna and striped marlin

Australia's yellowfin tuna (*Thunnus albacares*), albacore tuna (*T. alalunga*), bigeye tuna (*T. obesus*) and striped marlin (*Tetrapturus audax*) are target commercial species managed by the AFMA as part the Eastern Tuna and Billfish Fishery (ETBF) on the east coast and the Western Tuna and Billfish Fishery (WTBF) on Australia's west coast. The ETBF extends from Cape York, Queensland to the South Australian/Victorian border, encompassing the AFZ around Tasmania. Long lining is the predominant method of capture in the ETBF, though 'minor line' methods (trolling, hand lining and rod and reel fishing) are also employed. The ETBF has historically been managed by input

controls (including limited entry, gear and area restrictions) and restrictions on by-product and by catch. However, output controls (i.e. TACs and ITQs) have been proposed and are likely to be implemented.

Small quantities of albacore and bigeye tuna are caught by commercial operators in Tasmanian waters. The Bureau of Rural Sciences *Fishery Status Reports 2008* suggest that both yellowfin and bigeye tuna fisheries in Australian waters are overfished, the albacore tuna fishery is not overfished while the status of striped marlin is uncertain (Wilson *et al.* 2009).

Since 2004, the AFMA's management of the ETBF has been within the framework of *The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean* (The Convention). The Convention is managed by the WCPFC, which is represented by thirty-seven member nations, cooperating non-members and participating territories. The primary objective of The Convention is the effective management and conservation of highly migratory fish stocks (primarily tunas, billfish, mackerels and pelagic sharks) within the area under the jurisdiction of The Convention. Efforts to achieve this objective are made through compliance with UNCLOS and also UNFSA, and are based on the principles of sustainable use, long-term conservation and the precautionary approach.

Striped tuna

Striped (skipjack) tuna (*Katsuwanus pelamis*) are widespread in Australia's oceanic waters, though their location and abundance vary considerably between seasons. Historically, striped tuna was managed as part of the ETBF and WTBF; however, striped tuna is predominantly taken by purse-seine rather than by line techniques employed for other ETBF and WTBF species. As a consequence, the species is now managed separately as the Western Skipjack Tuna Fishery (WSF) and the Eastern Skipjack Tuna Fishery (ESF). Both fisheries are managed by limited entry, but it is envisaged that the fishery may become managed through output controls (ie TACs and ITQs) when the Management Plan, which is currently being developed, is

formalised. The ESF also falls within the jurisdiction of the WCPFC; however there are currently no harvest strategy arrangements for this species under the Commission. Skipjack tuna are considered to be not overfished in the WCPO and Indian Ocean (Wilson *et al.* 2009).

Mako shark and blue shark

Pelagic sharks are not regarded as target species by any Commonwealth or State commercial fishery. However, mako sharks (*Isurus oxtrinchus*) and blue whaler sharks (*Prionace glauca*) occasionally represent a significant portion of the shark by-product and by-catch in commercial fisheries, particularly in south eastern Australia. These fisheries include the Eastern Tuna and Billfish Fishery (ETBF), the South East Non-Trawl Fishery (SENTF) and the Southern Shark Fishery (SSF). Fishery based arrangements for the retention of sharks as by-catch include Management Plans, Fishing Permit conditions, Memoranda of Understanding and OCS arrangements between the Commonwealth and the States. These arrangements are guided by a National Plan of Action for Sharks (NPAS) which was developed in 2004 to address shark conservation and management issues. The development of the NPAS followed the formulation of the *International Plan of Action for the Conservation and Management of Sharks* (IPOA-Sharks) by the United Nations Food and Agriculture Organisation (UN-FAO) in response to concerns of global overexploitation of shark fisheries.

2.4.2 Recreational fisheries

As for all marine recreational fisheries in Tasmania, angling of game species is managed under the *Living Marine Resources Management Act 1995,* which is guided by ESD principles. The *Act* bestows jurisdiction upon the Wild Fisheries Management Branch of the Department of Primary Industries, Parks Water and Environment (DPIPWE) to administer rules and regulations to manage Tasmania's marine recreational fisheries. The management of all recreational fisheries in Australia is guided by the goals and principles of the *National Recreational Fishing Policy 1994.*

A licence fee is not required to fish for marine finfish in Tasmania. Fishers are however required to observe regulations regarding possession limits, length limits, gear type and seasonal closures for selected species. Regulations are founded on ecological and biological knowledge of fish stocks and the aquatic environment and are made in consultation with stakeholder groups. For some prominent fisheries, management information is detailed in fisheries Management Plans. However, a Management Plan for the game fishery has not been developed. Fishing regulations for game species are detailed later in this section.

Since 2003, a ministerially appointed Recreational Fisheries Advisory Committee (RecFAC) has operated as a forum to provide advice on resource management and policy issues in relation to marine recreational fishing in Tasmania. Proposed changes to regulations and policy are generally discussed by RecFAC members: From these discussions, advice is provided to the Minister, along with Departmental advice. RecFAC is made up of representatives from various recreational fishing associations (including the Tasmanian Game Fishing Association), industry associations (i.e. the Sea Charter Boat Operators of Tasmania), regional fisher representatives, conservation interests, the Tasmanian Marine Police and research agencies. A member from the Tasmanian Association for Recreational Fishing (TARFish) is also represented on RecFAC. TARFish is a fully independent peak body representing the interests of Tasmanian recreational fishers and operating as the Tasmanian representative on the Australian Recreational and Sport Fishing Industry Confederation Inc (RECFISH Australia), which is the peak body representing the interests of recreational fishers in Australia.

Fishing regulations

The recreational gamefish fishery is regulated through the use of possession limits – size limits, seasonal closures and gear limits are not applicable for game species. A combined possession limit of two southern bluefin, yellowfin or bigeye tuna currently exists. Possession limits have replaced traditional bag limits and apply everywhere, including the home. A possession limit of 10 and 15 applies for albacore and striped tuna, respectively. For mako and blue

sharks, a possession limit of two per person and a boat limit of five sharks apply. In the absence of an explicit possession limit for striped marlin, the default limit of 15 for non-specified species applies. However, anecdotal evidence suggests that sightings and catches of this species are rare but appear to be becoming more frequent, possibly due to environmental changes mediated by climate change.

Charter boat industry

Charter boat customers are recognized as recreational fishers and are therefore subject to the species possession limits described above. The management of the charter boat industry in Australia is the responsibility of individual State and Territory authorities. In Tasmania, charter boat operators are encouraged to become members of the State peak representative body, the Sea Charter Boat Operators of Tasmania (SCBOOT). While SCBOOT membership is not compulsory, members gain accreditation with the Tasmanian Tourism Council and become recognized by Marine and Safety Tasmania (MAST) and the Fishing Industry Training Board. A voluntary code of practice exists for SCBOOT members which promotes sustainable fishing practices and encourages the use of logbooks for recording catch and effort information. The charter boat industry plays a role in the decision making process by being represented on the RecFAC board. A management plan is currently being developed for the charter boat sector.

CHAPTER THREE

General Methods

3.1 Overview and justification of survey methods

To address the objectives of the study, a methodological approach capable of collecting detailed social and economic data from fishers was required. Addressing the objectives also required the collection of largely quantitative data which was necessary to facilitate comparisons with similar studies. Accordingly, mail questionnaires were deemed the most appropriate survey instrument.

The recognition of two discernable angling groups within the Tasmanian game fishery required a sampling design to effectively sample both groups. However, the lack of a sampling frame (i.e. a licence registration database) for either group required the consideration of various survey methodologies to access fishers. Intercepting fishers at boat launching ramps to distribute questionnaires was considered but disregarded due to limitations of project resources and logistical difficulties[10]. Instead, it was decided to access potential private boat owning game fishers through the boat registration database and, in a separate survey, seek assistance from charter boat operators (CBOs) to distribute questionnaires to game fishing patrons.

This survey approach successfully addressed the collection of quantitative socioeconomic data. However, for private boat fishers, mail questionnaires were not amenable to the collection for detailed trip related data (i.e. expenditure, catch and release details), and therefore additional information was required to address objectives relating to catch and release behaviour and resource valuation. Accordingly, a telephone administered diary survey was also conducted to collect details of each trip undertaken by anglers in a

[10] As the Tasmanian game fishery has a small number of participants compared to many fisheries studied, intercepting sufficient numbers of fishers would have probably required the interception of fishers at all three major access points (St Helens, Eaglehawk Neck and Southport) during weekends over the course of the game fishing season.

manner that minimised recall bias. Details of all data collection methods and sampling design are presented below.

3.2 Angler questionnaires

3.2.1 Questionnaire development and design

An eight page questionnaire was developed to collect social and economic information from game anglers. The questionnaire included questions that have proven effective in previous fisher surveys, plus other questions informed by a preliminary understanding of Tasmanian game fishers[11]. The majority of the questions elicited quantitative data; however, two open-ended questions at the end of the survey provided respondents an opportunity to comment on fishery-related issues. The majority of the questions pertained to aspects of respondent's general involvement in the game fishery. This included information enabling an assessment of fishers' general fishing profiles, species preference, commitment, fishing abilities, peer group participation, motivations, consumptive orientation and attitudes to hypothetical management options. Demographic details of respondents were also collected.

The two questionnaires were designed to collect comparable data (see Appendices 1 and 2). There were however, a few notable differences between the questionnaires owing to fundamental differences between the two angling populations and due to differences in the respective sampling designs. In regard to the former, only the private boat fishers' questionnaire contained questions pertaining to boat ownership and non-trip related game fishing expenditure[12]. In regard to the latter, trip details for private boat fishers such as trip-related expenditure and catch and effort data were based on *all* trips

[11] This understanding was based on personal participation as a game fisher, preliminary conversations with CBOs and fishers, and through previous studies relating to the fishery (Smith, 1994; Morton and Lyle, 2003).

[12] Non-trip related game fishing expenditure data was not collected from charter boat fishers based on the assumption that such expenses would be negligible. This assumption was informed by the recognition that charter boat fishers do not incur boat related expenses and that, based on advice from CBOs, only about 5% of charter boat fishers supply their own fishing equipment.

undertaken during the season; for charter boat fishers, such details were collected for one trip only.

Both questionnaires were prefaced with completion instructions, information about the nature of the research, potential benefits of the results, ethics approvals, a privacy disclaimer and contact details of the survey investigators. At the end of both questionnaires, respondents were asked to indicate whether they were available to be contacted for response clarification. Furthermore, the private boat fishers' questionnaire concluded with an invitation for respondents to participate in a follow-up diary survey covering the 2007 fishing season.

3.2.2 Pilot survey

The final format of the questionnaires was largely informed by a pilot study undertaken between March and May 2006. After prior consultation, three CBOs from Eaglehawk Neck agreed to distribute questionnaires to patrons. The pilot questionnaires were accompanied with pre-paid self addressed return envelopes plus a comment sheet to invite feedback.

Twenty-nine of the 90 pilot questionnaires distributed to charter boat operators were returned, equating to a response rate of 32.2%. Numerous changes to the 2007 charter questionnaire were prompted by three aspects of the pilot study; the manner in which questions were (or were not) answered, feedback invited on the comment sheet, and a poor rate of response. In relation to the first two, questions were re-worded, re-sequenced and, in some cases, omitted. In relation to the latter, the questionnaire was shortened as numerous researchers have observed that response rates for mail surveys are somewhat inversely related to the length and complexity of the survey instrument (i.e. Brown *et al.* 1989; Connelly *et al.* 2003; Sharp *et al.* 2005). The visual appearance of the coverless pilot questionnaire was also perceived to be a factor contributing to the low response rate. Accordingly, a colourful cover was designed incorporating design principles suggested by Gendall (2005) to enhance response rates.

The pilot survey format was tailored to charter boat fishers; therefore, questions eliciting trip details as used in the private boat fishers questionnaire, were not tested during the pilot study. For these questions, members of the supervisory team plus six volunteers with game fishing experience were invited to assess them. Based on feedback from this process, minor changes were made.

3.2.3 Public awareness

Two measures were undertaken to increase awareness of the project. Firstly, in an effort to generate support for the project among CBOs, a presentation was made at a charter boat management meeting in July 2006 to discuss the impending survey and outline the potential benefits for the game fishery. Secondly, in an effort to generate awareness of the project among fishers, an article describing the project was published in the October/November 2006 edition of the *Tasmanian Fishing and Boating News.*

3.2.4 Sampling design and questionnaire distribution

Private boat fishers

Private boat game fishers were accessed using State managed boat registration details. The statutory body charged with the administration of this information - Marine and Safety Tasmania[13] (MAST) - agreed to cooperate with this study by sending mail questionnaires to boat owners identified as being most likely to own a vessel used for game fishing. Due to privacy issues surrounding third party access to boat registration information, MAST agreed to distribute questionnaires under their name as they perceived value in some of the questions for their own purposes. It was also agreed to incorporate additional questions relating to boating safety at the end of the questionnaire.

Boat owners were identified as being most likely to own a vessel used for game fishing based on vessel type and size. Vessels longer than 6 metres in

[13] MAST is a statutory body responsible for the management and registration of recreational and commercial vessels, licensing of operators plus the oversight of marine facilities.

the following categories – motor cruisers, open runabouts, dinghies, half-cabins, and quarter-cabins – were identified as being most likely to participate in game fishing. Accordingly, owners of all 1653 registered boats meeting these criteria were sent questionnaires. To take the overall number of questionnaires to 2000, a further 347 owners of boats in the second most likely category - half-cabin and quarter-cabin boats between five and six metres – were also sent questionnaires.

Questionnaires were sent during September 2006 and invited participation from recipients who participated in game fishing during the 2006 season. They were each marked with a unique code used to identify those who did not return their questionnaires. The questionnaires were sent with a pre-paid self-addressed envelope. Two weeks after posting, non-respondents were sent reminder letters.

Charter boat fishers

Prior to questionnaire distribution, CBOs were identified and contacted. They were identified through advertisements placed in *The Yellow Pages*, *Tasmanian Fishing and Boating News* and local area directories on the internet. Regional tourist information services, the Tasmanian Aquaculture and Fisheries Institute (TAFI) and Sea Charter Boat Operators of Tasmania (SCBOOT) were also consulted to obtain contact details of CBOs. Twenty CBOs were identified and contacted, either in person or by telephone. Fifteen CBOs volunteered their participation, four indicated that they would not be operating during the 2007 season and one operator refused to participate. Of the 15 volunteering CBOs, six were based at St Helens, four at Eaglehawk Neck, one each at Southport and Flinders Island and three operated from both Eaglehawk Neck and Southport (see Figure 1).

CBOs were initially supplied with questionnaires in January 2007 and were asked to distribute them to all fishers over the age of 16 years on all trips in which game species were targeted, whether or not other species were also targeted, and whether or not fish were caught. CBOs were supplied with sufficient questionnaires to satisfy requirements based on the anticipated

number of clients over the short term. Contact was made by telephone approximately every four weeks to encourage participation and determine whether additional questionnaires were required. At the end of the game fishing season (July 2006), CBOs were contacted to determine the number of undistributed questionnaires.

3.2.5 Incentives

As an incentive for private boat fishers to complete and return questionnaires, two prizes were awarded in a lottery type draw. The first prize was self-inflating personal floatation device and the second prize was a fishing tackle voucher to the value of $150. As an incentive for charter boat fishers to complete and return questionnaires, a $1000 fishing tackle voucher prize was offered to one randomly selected respondent in a lottery type draw at the end of the game fishing season[14]. To provide an incentive to CBOs to deliver questionnaires to clients, a $500 fishing tackle voucher was awarded to the CBO who delivered the winning questionnaire[15]. Prizes were supplied by a fishing tackle retailer in exchange for the display of their logo on questionnaires.

3.2.6 Response rates

Private Boat Fishers

Of the 2000 questionnaires sent, 56 were not deliverable and were returned. A total of 277 were returned by respondents who indicated game fishing participation over the 2006 season. When incomplete questionnaires were omitted, 264 were deemed suitable for analysis. Therefore, the effective response rate, accounting for non-deliverables and unusable questionnaires, was 13.6%. However, this response rate cannot be compared with studies that use a sampling frame of eligible participants as not all boat owners who were sent questionnaires would have been game fishers, or indeed fished for any species of fish during 2006. Therefore, without knowing the number of private

[14] Respondents to both questionnaires were only eligible for the prize if they completed the questionnaire in a satisfactory manner.

[15] Questionnaires were linked to the distributing CBO through a unique code printed on each survey.

vessels used for game fishing, it is not possible to calculate an effective response rate among game fishers. Nonetheless, given the specialist nature of this fishing activity, the response rate is expected to have been substantially greater than 13.6%.

Charter boat fishers

In total, 1716 questionnaires were distributed to CBOs over the 2007 season. Contact with CBOs at the end of the season suggested that about 650 questionnaires had not been distributed to fishers. A total of 204 questionnaires were returned by game fishers. After accounting for incomplete and multiple questionnaires submitted by individuals, 176 questionnaires were deemed usable. An accurate determination of angler response rate was however, not possible due to perceived inaccuracies in information obtained from some CBOs regarding the number of questionnaires distributed. This assessment was based on marked differences in rates of survey return from questionnaires distributed by different CBOs. Despite receiving questionnaires from patrons of 13 of the 15 volunteering CBOs, it appeared that some CBOs only distributed a small proportion of the questionnaires supplied and/or underestimated the number of remaining questionnaires at the end of the season. O'Malley and Glazier (2003) experienced similar difficulties using a comparable method of distributing questionnaires to charter patrons. The problems encountered by O'Malley and Glazier were recognised prior to implementing the current survey; however, similar problems were expected to be alleviated by maintaining frequent contact with CBOs and using a generous prize as an incentive to deliver questionnaires.

An overall crude calculation suggests that only 19.1% of all questionnaires reportedly distributed to fishers from CBOs were returned. However, a more realistic response rate is thought to be closer to 40% based on the response rates of 42.0% and 37.3% for questionnaires distributed by two CBOs for which the highest numbers of questionnaires were returned by fishers. It is therefore likely that other participating CBOs may have been selective in their distribution of questionnaires.

3.3 Telephone administered diary survey

3.3.1 Survey development and design

A diary survey administered by telephone was used to collect detailed trip-related information from private boat fishers including expenditure, catch and effort details, travelling distances and trip lengths. The general design philosophy of the telephone/diary methodology is described by Lyle *et al.* (2002). In brief, the approach seeks to transfer the burden of participation from the respondent to trained interviewers who maintain regular contact by telephone and collect details of each fishing event. Accordingly, recall bias effects on data quality are minimised.

The diary survey required participants to record 'trip details', 'catch details' and 'personal expenditure and travel details' from game fishing trips over the 2007 season in diaries provided[16]. This information was collected through regular telephone contact with diarists in addition to other details perceived to be too onerous for respondents to manually record in diaries. Therefore, the 'basic' information recorded in diaries also served as a 'memory jogger' for more detailed information to be collected during routine telephone interviews. At the conclusion of each interview, arrangements were made for the next contact, based on further trips planned.

3.3.2 Survey implementation and response

Participation in the diary survey was invited through the private boat game fishers' mail questionnaire whereby a description of the impending survey was provided. In total, 164 respondents indicated their willingness to participate.

In January 2007, two interviewers were recruited and trained to conduct diary interviews. Prior to survey commencement, each angler was contacted to confirm participation and explain the survey in greater detail. Of the 164 game fishers who initially expressed willingness to participate, seven were unable to

[16] See Appendix 3 for the survey instrument (i.e. interview script) and fishing diary.

be contacted, and 13 withdrew their support. Of the remaining 144 participants, postal addresses were collected to enable survey kits to be sent. Survey kits contained a diary plus information on the scope of the research, identity of researchers, research aims and purposes, privacy and ethics issues and contact details of researchers.

After survey kits were sent, introductory interviews were undertaken whereby survey requirements and key concepts[17] were explained and uncertainties clarified. At the end of the introductory interview, participants were asked of impending game fishing plans and the timing of first survey interviews were planned accordingly.

Throughout the season (January – July 2007), diarists were called at times by mutual agreement at a regularity that reflected their frequency of participation; typically as soon as possible after fishing trips to reduce recall bias for data not recorded in diaries. If a respondent indicated that s/he was not planning on undertaking more trips, follow-up calls were made regardless, but at less frequent intervals. As a general rule, diarists were called at least monthly even if no fishing trips were planned.

3.3.3 Response rate

Of the 144 initial participants, 14 proved too difficult to contact during the season to collect reliable data. Of the remaining 130 diarists, 100 recorded game fishing trips during the 2007 season. At the end of the season, all 100 diarists who submitted information gave their permission to be contacted if further clarification was required about their responses during data collation

[17] Integral to the survey was ensuring that diarists understood what was meant by the terms 'fishing trip' and 'expenditure attribution', as used in the survey. The former was defined as any trip undertaken in which game species were targeted, whether or not any game fish were caught, whether or not game fishing was the primary motivation for making the trip and whether or not other fishing types and/or other activities were undertaken. The duration of a game fishing trip was further defined as the time from leaving ones primary residence to the time in which one returned. Expenditure attribution, as it referred to game fishing, was explained using an example whereby items were purchased on a trip in which the hypothetical angler played golf and fished for lobster in addition to targeting game fish.

and analysis. Furthermore, 99 diarists indicated their willingness to participate in a supplementary survey of fishery-related issues (see below).

3.4 Supplementary survey

Due to issues arising throughout the implementation of the three surveys, it became apparent that the overall survey could benefit from extra information from game fishers. The supplementary survey provided an opportunity to canvas these issues with game fishers who had already demonstrated willingness to provide information.

The supplementary survey was administered by telephone and consisted of four pages of questions (Appendix 4) and took, on average, 30 minutes to complete. The survey was preceded by a confidentiality reminder and was divided into six sections pertaining to the following themes; (1) satisfaction and season evaluation, (2) gamefish preference, (3) catch and release of southern bluefin tuna, (4) angler-seal interactions, (5) sustainability, and (6) valuation of fishery access. All 99 anglers completed the survey.

CHAPTER FOUR

Exploring diversity among Tasmanian gamefishers using recreational specialisation

4.1 Introduction

Increasingly, fisheries managers are recognising the value of using segmentation techniques to explore diversity within recreational fishing populations. Studies consistently demonstrate that angling populations are heterogeneous groups of individuals with differing values, behaviours and attitudes. Furthermore, most studies acknowledge the need to recognise heterogeneity in a management framework that maximises acceptance of and compliance with regulations and policies among angling sub-populations. Earlier studies that recognised anglers as heterogeneous assemblages focused on exploring diversity by developing typologies based on angler's attitudinal and motivational characteristics (Driver and Cooksley, 1977; Manfredo *et al.* 1978; Phillips and Ferguson, 1977). An alternative approach to addressing angler heterogeneity is by adopting the conceptual framework of recreational specialisation. In his seminal study of Wyoming trout anglers, Bryan (1977: 175) defined recreational specialisation as "a continuum of behaviour from the general to the particular, reflected by equipment and skills used and activity setting preferences". Bryan first applied the concept to segment the trout angling population into four different sub-groups: occasional anglers, generalists, technique specialists, and setting-technique specialists. Anglers were segmented according to their frequency of participation, setting preferences, equipment, the importance ascribed to catching fish, social setting, and management preferences. According to Bryan, highly specialised anglers (i.e. setting and technique specialists), are extremely committed to fishing and use sophisticated techniques and equipment. Conversely, least specialised anglers (occasional anglers) have little regard for the activity and do not show a discernable preference for equipment or technique.

The concept of recreational specialisation has gained increasing acceptance as a means of understanding the multi-faceted nature of recreationist behaviours, values and attitudes. It has also become an accepted means to assess populations of recreationists by segmenting the population into discrete and meaningful groups, often with management implications. Despite different approaches taken to measure and apply recreational specialisation, studies have consistently demonstrated differences between specialisation mediated sub-populations of anglers. Indeed, from a sociological perspective, Hahn (1991: 380) suggests that "specialisation in the key determinant of anglers' perceptions, expectations, motivations, satisfactions, and the meanings attached to fishing".

4.1.1 Measuring specialisation

In the absence of a definitive approach to characterising and measuring recreational specialisation, studies have used a variety of variables to measure the concept and techniques to segment participants into specialisation-based categories. In their review of recreational specialisation, Scott and Shafer (2001: 325) asserted "beyond the recognition that recreational specialisation includes a set of behaviours and attitudes, there remains little agreement about how precisely to characterize and measure the construct". Two earlier studies by Graefe (1980) and Ditton *et al.* (1992) used avidity as a single item measure of angler specialisation. Graefe (1980) found that more specialised (i.e. avid) anglers were more skilful, preferred diverse fishing settings and had a greater resource dependency. Ditton *et al.* (1992) also demonstrated a greater resource dependency for more avid anglers in addition to a higher level of mediated interaction and greater importance attached to non-catch elements of the fishing experience.

More recent studies have developed indices comprised of multiple specialisation-related items. While various approaches have been undertaken, a consensus appears to be emerging whereby specialisation indices need to comprise three general sub-dimensions: a behavioural dimension measured by frequency and/or history of participation, a cognitive dimension measured by

skills and knowledge, and a psychological dimension measured by commitment. This three dimensional approach proposed by McIntyre and Pigram (1992) and refined by Scott and Shafer (2001) builds on works by Bryan (1977; 1979), and has strong empirical support from various studies (i.e. Lee and Scott, 2004; Oh *et al.* 2005; Oh and Ditton 2006; Oh and Ditton, 2008). Scott and Shafer (2001) suggested that the three dimensions are interrelated and mutually reinforcing, which therefore facilitates their use within an index designed to measure the same underlying factor - that is, specialisation. The three components are discussed below.

The behavioural dimension should reflect an individual's participation at the expense of other activities (Scott and Shafer, 2001). Behavioural indicators used by outdoor recreation researchers in specialisation studies include years of experience, frequency of participation, the number of sites visited, distance travelled to participate and activity related expenditure. However, the majority of studies on angler specialisation have used avidity (the number of days fished in a 12 month period) and/or years of experience as items measuring behaviour.

A large volume of outdoor recreation research recognises that the acquisition of skills and knowledge relating to an activity is linked to an individuals' past experience. At first glance, this recognition may preclude skills and knowledge as a separate dimension if they are simply a function of experience. However, Scott and Shafer (2001) argue that the relationship between the two is not necessarily linear or predictable because individuals differ in their effort, desire and/or ability to acquire skills and knowledge. Therefore, they agree that the inclusion of skills and knowledge as a unique dimension in specialisation indices is not only justified but necessary to properly encapsulate the full complexity of the specialisation construct. Measures of skills and knowledge commonly used in angler research are self evaluated skill ranking and level of skill/knowledge constraints to participating. Typically however, despite the broad adoption of the three dimensional approach among outdoor recreation researchers since 2001, the knowledge facet of this dimension is often ignored in studies of anglers.

The third component, commitment, is the degree of personal and behavioural investment that recreationists accrue over time (Scott and Shafer, 2001). In the recognition of commitment as a multi-dimensional concept with psychological and behavioural components (Buchanan, 1985), Scott and Shafer (2001) distinguish between personal and behavioural commitment. Personal commitment entails the development of a self-identity whereby an individual defines oneself in reference to the activity. Behavioural commitment, on the other hand, comprises expectations and costs that make discontinuation of the activity problematic. Scott and Shafer further assert that recreationists who demonstrate a high degree of both are likely to view the activity as a central life interest. A common example of a personal commitment variable is a self evaluated measure of importance of the activity relative to other activities. Examples of variables measuring behavioural commitment in angling studies include the replacement cost of fishing gear, fishing club membership, and tournament participation.

As mentioned, the three specialisation sub-dimensions are interrelated and mutually reinforcing. Therefore, the specialisation framework demonstrates iterative circularity such that an increase in one dimension is expected to increase the likelihood of an increase in another. The strong theoretical interrelationships between the sub-dimensions can result in ambiguity over the categorisation of some items. For example, measures of participation such as experience and avidity may be viewed as measures of either behaviour or commitment. Nonetheless, once incorporated in an index, theoretical arguments about which component an item belongs to should be of little value providing all components are comprehensively represented and are measuring the same latent factor – again, specialisation.

In this study, a specialisation index was created using items from the three sub-dimensions discussed above. Discrete groups of fishers defined by similar characteristics were then identified by segmenting the index data using cluster analysis. Responses to survey items pertaining to eight categories were then compared between specialisation-mediated angler groups. In the following

section, a review of the recreational fishing literature is presented to guide predictions of how differently specialised fishers are expected to respond to these items

4.2 Literature review

4.2.1 Game fishing sector

In the only study I am aware of that has explicitly compared relative angler specialisation between charter boat and private boat fishers; Salz *et al.* (2001b) observed a higher proportion of highly specialised fishers among the latter group. However, the study sampled fishers chartering boats known in the United States as 'party boats'. These differ from the charter boats referred to in the current study in that they charge a fee per customer for regularly scheduled trips rather than operate on a fixed fee per trip basis. As larger boats, they generally accommodate many more fishers than 'charter boats' that are generally chartered by small groups. Based on these differences, the results cannot be used to inform predictions about specialisation in the current study. In a separate study, Ditton *et al.* (1998) observed mean differences between three specialisation related variables (avidity, experience and skill level) between private boat and charter boat fishers targeting Atlantic bluefin tuna. While comparing specialisation between the two types of anglers was not central to the study, the results suggest that private boat fishers were, on average, more specialised than charter boat fishers. These apparent differences accord with the suggestion by Hahn (1991: 385) that "anglers in charter boats, party boats, and private boats may differ from one another in significant ways".

4.2.2 Demographic factors

Studies have suggested that socio-demographic indicators have the potential to be mediating factors in specialisation measurement (Bryan, 1979; Kuentzel and McDonald, 1992; Scott and Shafer, 2001). While demographic variables have not been a primary focus of any studies on angler specialisation, the potential usefulness for managers is apparent if significant relationships do

exist. For managers to utilise the results of specialisation studies, identifying groups through demographic variables as specialisation indicators is potentially less problematic than using other indicators. While demographic variability within angling populations is routinely demonstrated (eg Vigliano *et al.* 2000; Marta *et al.* 2001; Gentner and Lowther, 2002; Ditton and Stoll, 2003), specialisation-related studies have largely ignored demographic items as independent variables (one exception is provided by Oh *et al.* [2005] and is discussed below). For non-angling outdoor recreation studies, specialisation level has been found to increase with income, age and education level among recreational birdwatchers (Martin, 1997; Cole and Scott, 1999; Hvengaard, 2002).

Age

Due to the lack of conclusive empirical or theoretical support, it is difficult to hypothesise relationships between specialisation and demographic variables. However, as the specialisation concept entails a *progression* of behaviour (Scott and Shafer, 2001), it may be considered a logical extension to assume that experience will have a positive relationship with age. However, in a study of three angling modes – private boat, party boat and shore-based - this relationship was only observed among party boat fishers (Salz *et al.* 2001b).

Income and education

Chipman and Helfrich (1988) suggested that income and education levels of some fishers may prevent them from attaining a highly specialised status. In support, Scott and Shafer (2001: 337) suggested that "participation and progression in a range of activities may be problematic for individuals who are poor and who have lower levels of education". These claims were not empirically tested; however, in another study, Oh *et al.* (2005) identified a positive relationship between specialisation and incomes of freshwater impoundment fishers. While these three studies provide support for a relationship between specialisation and income among recreationists, it is furthermore reasonable to assume that financially mediated effects on specialisation will be most acute for activities requiring high costs of participation. In terms of different angling types, the capital and trip-related

costs associated with offshore game fishing define its reputation as an expensive pursuit.

Club membership

Bryan (1977) has suggested that more specialised recreationists are oriented towards group identification with other members of the social world that is central to the activity. Accordingly, affiliation with fishing clubs or organisations has been used as an item representing the commitment dimension by various researchers in studies of anglers (Chipman and Helfrich, 1988; Oh *et al.* 2005; Oh and Ditton, 2006). In these studies, club membership was positively related to other items in the index, demonstrating its orientation to specialisation. Used as an independent demographic variable in his study of Texan anglers, Fisher (1997) reported that among the seven specialisation groups identified, the highest proportion of fishing club members was observed in the most specialised group. Furthermore, Gigliotti and Peyton (1993) observed that fishing club members were more experienced and avid than non-members.

4.2.3 Species preference

Bryan (1979) has also suggested that as recreationists become more specialised, there is often a progression in the types of experiences sought. He recognised that the nature of rewards is likely to change as an individual acquires skills, knowledge and experience. He further suggested that when rewards are attained too easily, recreationists are provided with a stimulus to progress along the specialisation continuum to gain fulfilment through seeking greater challenges. In a recreational fishing context, this may be manifested as a redirection in effort towards pursuing more challenging fishing styles, settings and/or species. "The generalist, tiring of numbers of game and fish, turns to the size or 'quality' of the catch or kill" (Bryan 1979: 53). The variation in size, prevalence, and ease of capture among Tasmania's game fish provides an opportunity to test this theory.

4.2.4 Social group participation

Bryan's (1977) theory of recreational specialisation suggests that social group affiliation is one dimension that may undergo progression as individuals gain experience in an activity. According to the theory, more specialised participants will often orient to social worlds that are identified by similar attitudes, beliefs and experiences of its members. In their re-conceptualisation of recreation specialisation from a social world perspective, Ditton *et al.* (1992) adopted a conceptual framework by Unruh (1979; 1980) to categorise participants into four trans-situational social sub-worlds – strangers, tourists, regulars and insiders – thought to parallel the specialisation continuum. These represent a progression of states in terms of their social proximity to knowledge about the social world. In terms of their relationships within the social world, strangers typically lack close relationships with other members. Conversely, regulars and insiders are thought to have frequent contact with other participants and tend to develop close friendships due, in part, to previous experience and continued participation.

While numerous studies have demonstrated the importance of social group participation in the fishing experience (Knopf *et al.* 1973; Falk *et al.* 1989; Fedler and Ditton, 1994; Calvert, 2002; Thomas and Vogelsong, 2003), very little work has been published on the relationship between specialisation and social group affiliation. From research that has used fishing club membership as an item within an index designed to measure specialisation (Chipman and Helfrich, 1988; Oh *et al.* 2005; Oh and Ditton, 2006), it is inferred that more specialised anglers are more likely to fish with club members than less specialised fishers. Furthermore, results from two angler-based studies that have used social group participation as motivational items (Chipman and Helfrich 1988; Salz *et al.* 2001) have indicated support for Bryan (1977) and Ditton *et al.* (1992), above. Chipman and Helfrich (1988) observed that the motive "to be with family" was significantly more important for least specialised anglers, while Salz *et al.* (2001) observed that the motive "to be with friends" was significantly more important for more specialised fishers. In light of conceptualisation by Bryan (1977) and Ditton *et al.* (1992), it is

plausible that members of a fishing "social world" are more likely to be friends or fishing club members than family members. Accordingly, it would be reasonable to expect more specialised anglers to fish with friends and fishing club members more often than less specialised anglers.

4.2.5 Motivations

Consistent with many studies of angling motivations, the items used in this study to measure motivations were developed by Driver and colleagues (Driver and Knopf, 1976; Driver, 1977; Driver and Cooksey, 1977). The items were developed to capture the psychological outcomes that recreationists receive from outdoor activities. Research on angler motivations generally distinguishes between catch-related and non-catch related motivations. Non-catch, or general activity motivations, includes elements that involve being outdoors, socialising and relaxing. Catch-related, or activity-specific motivations, refer to elements peculiar to the practice of angling such as catching and retaining fish.

Recreational specialisation theory proposes a shift in focus from catch-related motivations to non catch-related motivations as level of specialisation increases (Bryan, 1977; Ditton *et al.* 1992). In other words, highly specialised anglers are thought to attach greater importance to general activity experiences than less specialisation anglers, who are thought to attach greater importance to aspects of the fishing experience that are directly related to catching fish. In explaining this theory, Ditton *et al.* (1992: 41) suggested that less specialised anglers will "likely be aware of and seek only the most superficial and apparent elements of the experience". For more specialised individuals, Ditton *et al.* (1992: 41) described their approach to fishing as "wholistic" and suggested that "the 'authentic' recreation experience goes beyond simplistic surface elements".

Most contemporary studies of angler motivations use item scales originally developed and refined by Driver (1977) and Driver and Cooksey (1977) that divide non-catch motivations into three dimensions – *Psychological and*

Physiological, *Natural Environment* and *Social*. While the empirical literature is generally supportive of a relationship between specialisation and the importance of non-catch motivations, items relating to the social domain appear to be an exception. For example, Chipman and Helfrich, (1988) observed that fishing with family was more important for less specialised fishers and Ditton *et al.* (1992) observed no significant differences in importance ascribed to any social motivations between differently specialised groups.

Empirical results for catch related motivations are even less conclusive. A critical assessment of relevant studies suggests that little value is gained by claiming a relationship between specialisation and catch related motivations at an aggregate level. The wide scope of catch related motivations, which include fishing as sport, retaining fish, catching trophy fish and developing fishing skills appear to be of different importance to fishers of different specialisation level. For example, more specialised anglers rated the experience of catching fish (Ditton *et al.* 1992; Salz *et al.* 2001a; Oh and Ditton, 2008) and catching larger fish (Bryan, 1977; Chipman and Helfrich, 1988; Oh and Ditton, 2008) higher than lesser specialised anglers, who have, in turn indicated greater importance to keeping caught fish (Ditton *et al.* 1992; Salz *et al.* 2001a) than more specialised anglers.

For two studies that claim to validate the theory of overall greater importance of catch related motives by less specialised fishers (Ditton *et al.* 1992; Salz *et al.* 2001a), careful analysis of their studies raises uncertainty over their methodological approach, and therefore the validity of their claims. In both papers, the hypothesis was accepted based on the balance of significant differences in support given to item statements pertaining to catch related factors by differently specialised angler groups. While this approach is sound, not all 'factors' were unique or independent from other factors in the study. For example, two factors used by Salz *et al.* (2001a) – "I'm just as happy if I release the fish I catch" and "I'm just as happy if I don't keep the fish I

catch"[18] – are clearly not independent dimensions of activity-specific items. When these observations are addressed, the hypotheses by Ditton *et al.* (1992) and Salz *et al.* (2001a) that catch related motives are more important for less specialised fishers are not supported. To further underscore the apparent inconsistencies in this field of research, Salz *et al* (2001b) observed that for three modes of fishers – private boat, party boat and shore-based fishers - the relative importance that anglers placed on *every* reason (both catch and non-catch related) for going saltwater fishing increased with specialisation.

4.2.6 Consumptive orientation

Sutton and Ditton (2001: 52) define consumptive orientation as "the degree to which an angler values the catch related outcomes of the fishing experience". The concept was originally advanced as a scale developed by Graefe (1980) and refined in later studies (Ditton and Fedler, 1984; Fedler and Ditton, 1986; Fisher, 1997). The scale was designed to measure the importance of fishers' attitudes to catching fish, catching numbers of fish, catching large/trophy fish and retaining fish.

As the differentiation between consumptive orientation and some catch-related motivations is often unclear, the classification and treatment of scale items is somewhat inconsistent between studies. Graefe (1980) proposed that rather than being a motivational domain, consumptive orientation is an attitudinal domain, and therefore requires differential treatment. Oh and Ditton (2008) further support differential treatment by suggesting that unlike consumptive orientation, activity-related motivations are subject to influence by situational factors such as angling effort and the catch rate of accompanying anglers. Nonetheless, studies that have compared angler's responses to both demonstrate a high level of congruency (Fedler and Ditton, 1986; Aas and Kaltenborn, 1995; Kyle *et al.* 1997). Therefore, interpretation of the results will assume that the constructs are inherently similar and results

[18] The similarity between these two statements is reflected in their almost identical F values – 7.57 and 7.55. Other similar items used by Salz *et al.* (2001a) were "a fishing trip can be successful even if no fish are caught" and "when I go fishing, I'm just as happy if I don't catch a fish".

of both constructs will be discussed in association with each other. Furthermore, the broader theoretical foundation outlined above for activity-related motivations is also relevant for consumptive orientation. Nonetheless, results will be predicted for individual consumptive orientation domains based on more specific conceptualization and empirical testing.

For the domain, 'attitudes to catching fish', items measure the importance of catching fish as an element of the fishing experience, and anglers' dependency on fish capture on their satisfaction and perceptions of success. Ditton *et al.* (1992) and Salz *et al.* (2001) demonstrated that less specialised anglers were more oriented to this domain than more specialised anglers. This finding was consistent with that made by Bryan (1977), who proposed that less specialised anglers were more interested in superficial elements of the experience such as catching fish, at the expense of less apparent elements.

The rationale offered by Bryan (1977) and noted above could also be used to inform a hypothesis regarding the domain 'attitudes to catching numbers of fish'. Indeed, it was used to inform a hypothesis by Ditton *et al.* (1992); however, results were not significant. In another study, Salz *et al.* (2001b) observed that lesser specialised private boat saltwater anglers were more concerned about the quantity of fish caught. In two other studies linking specialisation with orientation to catching many fish (Fisher, 1997; Kyle *et al.* 2007), the results suggest a greater orientation by *more* specialised fishers. Kyle *et al.* (2007) segmented a population of freshwater lake fishers into four sub-populations based on consumptive characteristics. In one sub-population defined by an orientation to catching many fish, respondents demonstrated characteristics consistent with a high degree of specialisation – they were relatively experienced, highly satisfied and highly motivated by psychological motivators

In regard to 'attitudes to catching large/trophy fish' Bryan (1979) suggested that anglers will seek new rewards and challenges as they become increasingly specialised. Subsequently, studies have consistently supported this theory across diverse fisheries (i.e. Chipman and Helfrich, 1988; Ditton *et*

al. 1992; Fisher, 1997; Salz *et al.* 2001b; Kyle *et al.* 2007) and similar results are expected for the current study.

Bryan (1977) also suggested that anglers' focus shifts away from harvesting fish through the specialisation process. Studies that have addressed fishers attitudes to this domain of consumptive orientation have generally supported this theory (i.e. Chipman and Helfrich, 1988; Ditton *et al.* 1992; Salz *et al.* 2001a; Kyle *et al.* 2007). However, in a study of three saltwater fishing modes (private boat, party boat and shore fishing), Salz *et al.* (2001b) observed that more specialised fishers of all three modes showed a greater orientation to retaining fish. Nonetheless, based on the balance of evidence, I predict that less specialised fishers will express greater orientation to this domain than more specialised fishers.

4.2.7 Conservation orientation

As anglers become more specialised, there is thought to be a general shift in focus from fish consumption to resource conservation and a greater emphasis placed on the nature and settings of the activity (Bryan, 1977; Ditton *et al.* 1992). It follows then, that a greater dependency on the natural resources sustaining fishing activity results in more specialised anglers becoming more aware of and concerned about natural resource disturbances, and subsequently being more receptive to reducing adverse impacts (Fisher, 1997; Ditton *et al.* 1992; Oh and Ditton, 2008). Previous specialisation-based studies of anglers have used a variety of independent variables to measure conservation attitudes. These include agreement to attitudinal statements regarding specific aspects of the fishery (Salz and Loomis, 2005) and equally specific management proposals (Chipman and Helfrich, 1988; Fisher, 1997; Salz *et al.* 2001; Oh and Ditton, 2006). Less specific assessments of anglers' conservation orientation were made by Oh *et al.* (2005) and Oh and Ditton (2008) whereby consumer surplus values were obtained through non-market valuation techniques to infer the value that anglers placed on the resource. Though this approach was underpinned by the assumption that angler's willingness to pay for resource use was an effective surrogate measure of

conservation concern, the results generally supported studies using more specific indicators – that is, anglers become increasingly oriented to resource conservation through the specialisation process.

In the current study, coded responses to an open-ended question were used to solicit angler's awareness of and concern for the sustainability of the game fishery. To my knowledge, this approach has not been previously employed in studies of anglers. However, as observed in previous studies, a positive relationship between specialisation and conservation orientation is expected. The results will also be used as a lens to view the results of angler's agreement levels with specific management proposals (below).

4.2.8 Management preferences

Many studies on angler specialisation have used the specialisation framework to understand relationships between specialisation and support for various management tools (i.e. Chipman and Helfrich, 1988; Fisher, 1997; Salz *et al.* 2001a; Salz and Loomis, 2005; Oh and Ditton, 2006; Hutt and Bettoli, 2007; Oh and Ditton, 2008). This finding is not surprising since predicting how anglers will comply with management changes is a valuable outcome of this type of research. Specialisation theory predicts that more specialised anglers will be more supportive of regulations and restrictive management initiatives than less specialised anglers (Bryan, 1977; Ditton *et al.* 1992). This theory is founded on the premise that more specialised anglers are more dependent on the fisheries resource than less specialised fishers and will therefore be more adversely impacted if the quality of the fishery deteriorates. Therefore, regulatory measures intended to address resource sustainability are expected to be supported more highly by more specialised anglers (Ditton *et al.* 1992). Numerous studies have provided general empirical support for the theoretical foundation of the relationship (Chipman and Helfrich, 1988; Fisher, 1997; Salz *et al.* 2001a; Oh and Ditton, 2006; Hutt and Bettoli, 2007; Oh and Ditton, 2008). In further support of the relationship, studies that have evaluated support for less restrictive regulations (i.e. Chipman and Helfrich, 1988; Oh and Ditton, 2006), have shown greater support among less specialised anglers.

While the general consensus is supportive of Ditton *et al.* (1992), it appears that the relative level of support varies depending on the nature of sustainability based management initiatives. Most notably, three studies have observed that support for no fishing areas or closed seasons was either lower for more specialised fishers (Salz *et al.* 2001a) or similar between differently specialised fishers (Chipman and Helfrich, 1988; Salz and Loomis, 2005). In addressing these results, Salz and Loomis (2005) suggested that the relationship between specialisation and support for traditional regulations (i.e. bag limits and size limits) may not apply for regulations that restrict spatial or temporal access to fishing activity. In explaining this proposition, Salz and Loomis (2005) pointed to specialisation theory which suggests that as specialisation level increases, dependence on 'specific resources' will also increase (Bryan, 1977; Ditton *et al.* 1992).

4.3 Study objectives

As outlined in Section 1.2, the primary objective for Chapter Four was to assess the value of using the recreational specialisation concept to explore heterogeneity among fishers in a small scale small game fishery. Under the banner of this prescription, I endeavour to contribute to the development of the recreational specialisation concept by interpreting my findings (and those of other authors) in a manner that critically evaluates fundamental relationships underpinning recreational specialisation theory, as it pertains to recreational fishers. In doing so, attempts will be made to provide context (social, cultural, economic, political, managerial or otherwise) to explain results inconsistent with recreational specialisation theory. This will place the findings of the current study within the literature and may enable a clearer vision of population-specific issues that need to be considered and understood before the specialisation concept can be applied more broadly across and between angling populations.

In practical/methodological terms, these objectives were pursued by developing a three-dimensional index of Tasmanian game fishers in

accordance with the theoretical foundation of recreational specialisation. Specialisation related sub-groups were then identified using data segmentation techniques. The usefulness of this approach in exploring heterogeneity among fishers was then determined by evaluating the relationships between specialisation level and the following variables – fishing mode, fishing club affiliation, demographics, species preference, social group participation, conservation orientation, motivations, consumptive orientation and management preferences.

4.4 Methods

All data used for this study were collected by means of two mail questionnaires used for private boat fishers and charter boat fishers. Chapter 3 provides details on how the surveys were conducted. Due to incomplete data from some fishers for some data elements required for this study, data from 258 and 150 private boat and charter boat fishers were used, respectively.

4.4.1 Measurement of variables used for specialisation index

A specialisation index was developed according to a three dimensional model proposed by Kuentzel and McDonald (1992) and Scott and Schafer (2001). The model uses variables measuring three dimensions - *Behaviour, Skills and Knowledge* and *Commitment*. For *Behaviour*, three variables were used: the total number of days spent game fishing in the last 12 months, the number of years spent fishing during an angler's lifetime and the total number of game fish species that the angler has ever caught. The latter variable was used as a surrogate measure of experience and is underpinned by the reasonable assumption of a positive relationship between the likelihood of catching a 'new' species and the amount of time fished. For the *Skills and Knowledge* dimension, a single item was used depicting anglers' self-evaluated skill levels relating to game fishing. For the *Commitment* dimension, two items were used. The first was a measure of importance of game fishing relative to other types of fishing on a four-point scale. The second item was a measure of what anglers would do if they were no longer able to fish for their most preferred species (due to a population decline). The five response categories

were collapsed into two categories depicting whether anglers would either continue or discontinue game fishing (a decision to continue game fishing was assumed to be representative of more committed anglers).

4.4.2 Testing the validity of the specialisation index

All six items were standardised to values between 0 and 1. Principal Component Analysis (PCA: using SPSS 16.0) was used to determine whether all of the items selected for use in the index were measuring the same underlying factor, namely specialisation. PCA is a data reduction technique and is typically used to derive a relatively small number of 'components' (factors) that can account for the variability in a larger number if items.

The factorability of the data was assessed using three measures: correlation analyses between index items, Bartlett's test of sphericity (Bartlett, 1954) and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (Kaiser, 1974). Bartlett's test of sphericity (Bartlett, 1954) should be significant ($p < 0.05$) for the factor analysis to be considered reliable. Within the KMO index range of between 0 and 1, Tabachnick and Fidell (2007) suggest a minimum value of 0.7.

4.4.3 Segmentation of the angler population

To identify discrete homogeneous groups based on characteristics determined by the index variables, both hierarchal and K-means cluster (SPSS 16.0) were used. Hierarchical cluster analysis was used to determine the number of angler groups while K-means cluster analysis was used to determine the size of individual clusters.

The validity and effectiveness of the segmented specialisation construct determined through cluster analysis was tested by comparing specialisation clusters with eight groups of variables relating to: (1) fishing mode; (2) demographics; (3) species preference; (4) social participation; (5) motivations; (6) consumptive orientation; (7) conservation orientation and (8) attitudes to management. Unless stated otherwise, Chi-square tests for independence were

used to compare categorical data between angler groups and 1-Way ANOVA tests for independence were used for continuous data. Post-hoc ANOVA tests were conducted using Tukey's HSD. Significance for all tests was determined *a priori* at $p < 0.05$.

4.4.4 Variables

Mode

The proportion of differently specialised fishers was compared between private boat and charter boat fishers.

Demographic characteristics

Five demographic measures were compared between groups: age, personal income, employment status, highest level of education attained and fishing club membership.

Annual personal income ($AUS before tax) details of respondents were collected as categorical data. With the exception of the lowermost (< $20,000) and uppermost (> $100,000) income categories, data were segmented into $10,000 income categories. Accordingly, a total of 10 response categories were used. Analysis was undertaken to compare median incomes between differently specialised respondents.

Respondents were asked to nominate one of the following categories to best describe their current employment status: 'full-time employed', 'part-time employed', 'casually employed', 'self-employed', 'student', 'unemployed', 'retired', and 'non-retirement pensioner'. To address issues associated with low cell frequencies in Chi-square tests, the original eight ordinal categories were collapsed into four ordinal categories for analysis. Full-time, part-time and casually employed categories were collapsed into one category titled 'employed'. Likewise, unemployed anglers and those receiving a non-retirement pension (e.g. disability or veteran's pension) were collapsed into one group. No respondents nominated their employment status as 'student' and therefore this category was eliminated.

Respondents were also asked to nominate one of the following categories to best describe their highest level of education attained: 'junior schooling (≤ 15 years on age)', 'junior high schooling (> 15 years of age)', 'high school certificate or HSC/matriculation', 'trade qualification', 'diploma', and 'university degree'.

Species preference

Anglers were asked to nominate their preferred game fish species among those that they had reported catching[19]. Three species – striped tuna, yellowtail kingfish and blue shark – were excluded from analysis due to low numbers[20]. Therefore, of the eight species used in the surveys, five were retained for analysis – albacore tuna, southern bluefin tuna, yellowfin tuna, mako shark and striped marlin.

Social group affiliation[21]

The frequency by which respondents from specialisation groups fished with the following groups whilst game fishing were compared: 'alone', 'with friends', 'with family', 'with family and friends together', and 'with members of a fishing club'. Respondents were offered the choice of four response categories: 'never', 'sometimes', 'often' and 'always'. These were sequentially coded between 1 and 4 to represent participation frequency as nominal scale data i.e. 'never' was represented as 1 while 'always' was represented as 4.

[19] It was reasoned that fishers were not in a position to prefer a species if they had not caught that species. It was also reasoned that if species not caught were able to be nominated, a large percentage of fishers from both sectors would nominate striped marlin, a species rarely caught in Tasmanian waters.

[20] The inclusion of these species would violate the chi-squared assumption of minimum expected cell frequency

[21] Respondents were removed from analysis if they had only participated in one game fishing trip during their life at the time of being surveyed. These anglers were not considered to be in a position to provide information relating to this variable after only one trip. This resulted in the exclusion of eight and 27 private boat and charter boat fishers, respectively.

Motivations

Motivations for fishing were measured using 18 scale items developed and refined by Driver (1977) and Driver and Cooksey (1977). Ditton and Fedler (1994) suggest that researchers use these 'standard' statements due to their proven reliability and to enable comparisons between studies. Respondents were asked to evaluate the importance of each item on a five point scale from 'not at all important' (1) to 'extremely important' (5)[22]. Related items were grouped into four non-catch related categories (*Excitement and Adventure*,[23] *Escape and Relaxation, Natural Environment*, and *Social*) and two catch related categories (*Fishery Resource* and *Skills and Equipment*). Also used was a *Miscellaneous* category containing three unrelated items – "to participate in competition", "due to reports of good fish availability" and "due to reports of good weather conditions".

Reliability analyses determined that the internal consistency of all categories of items within groups were insufficiently reliable to be used as indices for their respective groups[24]. Consequently, further analysis was conducted on individual items only.

Consumptive orientation

Consistent with previous studies (i.e. Graefe, 1980; Ditton and Fedler, 1984; Fedler and Ditton, 1986; Fisher, 1997; Sutton and Ditton, 2001; Anderson *et al.* 2007), consumptive orientation was represented by four domains: *Catching Fish*; *Catching Numbers of Fish*; *Catching Large/Trophy Fish* and *Retaining Fish.* Thirteen 'standard' items from previous studies were used, plus an additional item that didn't correspond to any of the four domains, namely "it doesn't matter to me what type of fish I catch". This item was included to

[22] A sixth response category, "unsure" was also used. However, due to the low number of responses, data were excluded from analysis.

[23] Two categories – *Adventure and Excitement* and *Escape and Relaxation* - were created by allocating related items from the larger category *Psychological and Physiological* which is often used in motivational studies (Fedler and Ditton, 1994). This course of action grouped items that were theoretically more closely aligned, which was reflected in higher reliability scores for both categories compared to that obtained prior to allocating items

[24] The range of Cronbach's alpha coefficients was between 0.34 and 0.68 (see Table 10). Pallant (2007) cautions the use of indices with coefficients below 0.7. These low values precluded the use of exogenous mean values (i.e. indices) for all categories.

explore angler's attachment to particular fish species. For each item statement, respondents were asked to rate their level of agreement on a five point scale from 'strongly disagree' (1) to 'strongly agree' (5)[25].

Items in each of the four domains were summed to calculate an index for each domain, and then compared between specialisation groups. Reliability analyses determined that for two domains - *Catching Large/Trophy Fish* and *Retaining Fish*[26]- Cronbach's coefficient values were slightly less than the threshold value of 0.70 recommended by Pallant (2007). Therefore, results generated for these two domains will need to be interpreted cautiously. In a second tier of analysis, comparisons between specialisation groups were also conducted for each of the 14 items within the four domains.

Conservation orientation

Responses to the open-ended question "*What do you think is the most important issue facing the recreational game fishery in Tasmania*" were collapsed into a binomial variable depicting individuals' conservation orientation. The binomial approach assigned anglers to one of two categories: a 'conservation oriented' category and a 'non-conservation oriented' category. To qualify as conservation oriented, respondents were required to acknowledge the need to sustain fish stocks and/or preserve the aquatic environment in their response.

A closer inspection of conservation oriented responses revealed a considerable number of respondents who attributed all perceived threats to game fish viability to sources other than recreational fishing e.g. commercial fishing, pollution. Accordingly, a second binomial variable was developed to distinguish between responses offering a degree of ownership of the plight of game fish stocks by recreational fishers and those that didn't.

[25] A sixth response category, "unsure" was also used. However, due to the low number of responses, data were excluded from analysis.

[26] The item "I usually eat the fish I catch" was omitted from the domain to improve index reliability.

Management preferences

Respondents were asked for their level of agreement with seven proposed management scenarios and two general initiatives relating to game fishing in Tasmania. All scenarios were more restrictive than those prevailing at the time of the survey. Agreement levels were indicated on a five point scale from 'strongly disagree' (1) to 'strongly agree' (5)[8].

4.5 Results

Prior to PCA analysis, data were inspected for correlations between the six index variables. According to Tabachnick and Fidell (2007), PCA may not be appropriate if an item scores less than 0.3 on most of its correlation coefficients with other items. Accordingly, two variables were eliminated from further analysis due to the lack of coefficients greater than 0.3: the number of years spent fishing during an angler's lifetime and a measure of what anglers would do if they were no longer able to fish for their most preferred species. Using a four item scale incorporating the remaining variables, the Kaiser-Meyer-Oklin value of sampling adequacy was 0.7, exceeding the recommended minimum value of 0.6 (Pallant, 2007), and Bartlett's Test of Sphericity was significant (< 0.001), supporting the factorability of the correlation matrix.

PCA revealed the presence of only one component (specialisation) with an eigenvalue exceeding 1.0, a minimum value suggested by Pallant (2007) for component retention. Therefore, no further analysis was required to determine the number of components to be retained as all items appeared to be measuring the same latent factor. The component, which had an eigenvalue of 2.1, explained 52.7% of the variance. All items had factor loadings considerably greater than 0.4 on the component (Table 4.1), a minimum figure suggested by Sneath and Sokal (1973) for an item to make a significant contribution.

Table 4.1. Factor loadings for all items used

	Component 1
Number of species caught	0.783
Game fishing abilities	0.780
Game fishing avidity	0.687
Importance of game fishing	0.646

4.5.1 Segmentation of the angler population

Using hierarchical cluster analysis to determine the number of specialisation groups, Ward's Minimum Variance Method was used to measure the distance between clusters. The illustration of group formation by the dendogram produced from the hierarchical cluster provided robust grounds for the selection of between two and five cluster groups. Three groups were chosen to increase the likelihood of revealing significant differences with other variables and to facilitate potential managerial application. To be useful for managers, angler groups need to be substantial as addressing the needs of smaller groups would be a less efficient use of resources (Kyle, 2007). Also, the use of three specialisation clusters - *occasional*, *intermediate*, and *advanced* - facilitates comparisons with other studies of recreationists (Hvengaard, 2002; Oh *et al.* 2005; Oh and Ditton, 2006).

K-means cluster is a non-hierarchical approach to creating clusters whereby the number of clusters desired is chosen *a priori*. Of the three clusters specified, about 20% of individuals were classified as advanced anglers (n = 82), 65% intermediate (n = 265), and 15% occasional (n = 59). Compared to intermediate anglers, and in turn, casual anglers, advanced anglers were more likely to participate in a greater number of game fishing trips, rate their abilities higher, and have caught a greater number of game fish species during their fishing experiences (Table 4.2). Interestingly, there was an inconsistency between intermediate and casual anglers on the 'importance of game fishing variable'. Here, casual anglers were more likely to rate the importance of game fishing higher than intermediate anglers. However, the factor loading of 0.646 suggests that the variable was sufficiently consistent with the other variables for index retention.

Table 4.2. Mean values of specialisation index variables for advanced, intermediate and occasional fishers

Variable	Advanced (n=82)	Intermediate (n=265)	Occasional (n=59)
Number of species caught[a]	4.96	3.12	2.64
Game fishing abilities[b]	2.28	1.59	1.47
Game fishing avidity[c]	16.92	5.17	3.76
Importance of game fishing[d]	2.76	1.99	2.37

[a] denotes the number of game fish species that the angler has ever caught

[b] self-evaluated skill level relating to game fishing on a 3 point scale

[c] the total number of days spent game fishing over a 12 month period

[d] a measure of the importance of game fishing relative to other fishing types on a 4 point scale

4.5.2 Testing specialisation groups against variable groups

Angling mode

Significant differences were observed in the relative proportions of private boat and charter boat respondents within the three specialisation clusters: X^2 (2, n = 406) = 10.87, p = 0.004. The relative proportions of intermediate anglers were quite similar between the two sample groups (Table 4.3). However, there was a proportionally higher representation of advanced anglers in the private boat sample and a proportionally higher representation of occasional anglers within the charter boat sample.

Table 4.3. A comparison of proportions of differently specialised individuals between private boat and charter boat anglers

	Private Boat Fishers (n=258)	Charter Boat Fishers (n=150)
% Advanced	24.7	12.2
% Intermediate	63.3	68.7
% Occasional	12.0	19.0

Demographic characteristics

No significant differences in mean ages (advanced = 46.16, intermediate = 46.02, occasional = 43.44) were observed between angler groups: F (2, 403) = 1.488, p = 0.227.

A Kruskal-Wallis Test revealed a significant difference in personal income levels across the three specialisation based groups (advanced, n = 76; intermediate, n = 253, occasional, n = 58), X^2 (2, n = 387) = 6.390, p = 0.041. Advanced fishers recorded a median income of $60-70K, while both

intermediate and casuals fishers had a median income of $50-60K. A post-hoc analysis using Mann-Whitney U Tests revealed a significant difference between advanced and casual respondents only: $U = 1.641$, z = -2.552, $p = 0.011$[27], $r = -0.130$. Nonetheless, mean rank values for intermediate (194.75) and casual fishers (164.87) from the Kruskal-Wallis Test suggest that the predicted pattern of higher incomes for more specialised fishers was apparent across all three groups.

In regard to employment status, significant differences across specialisation groups were only observed for 'employed' anglers (i.e. full time, part-time and casual). The considerably lower proportion of employed fishers within the intermediate group was offset by higher proportions within the other three employment categories. However, these differences were not significant (see Table 4.4).

Table 4.4. A comparison of employment status among three specialisation categories of anglers

	Level of Specialisation					
Employment Category	% Advanced ($n = 81$)	% Intermediate ($n = 258$)	% Occasional ($n = 58$)	X^2	phi	sig.
Employed[a]	65.4	53.1	69.0	7.238	0.135	0.027
Self-Employed	28.4	35.3	25.9	2.691	0.082	0.260
Unemployed/Non-Retirement Benefits	1.2[b]	3.9	1.7[b]	1.858	0.068	0.395
Retired	4.9	7.8	3.2[b]	1.865	0.069	0.394

[a] Comprises full-time, part-time and casually employed categories

[b] Cells have counts less than the minimum expected count

In relation to level of education attained, 38.4% of all respondents nominated a trade qualification as their highest level of education attained. However, of the five educational categories used in the survey, no significant differences were observed between specialisation groups (see Table 4.5).

[27] A Bonferroni adjusted p value of 0.017 was used as the criteria for determining significance

Table 4.5. A comparison of the highest level of education attained among three specialisation categories of anglers

	Level of Specialisation					
Educational Category	% Advanced (n = 82)	% Intermediate (n = 263)	% Occasional (n = 56)	X^2	phi	sig.
Not Finished High School	17.1	15.6	23.2	1.907	0.069	0.38
HCS/Matriculation	15.9	17.5	12.5	0.864	0.046	0.64
Diploma	12.2	11.0	16.1	1.121	0.053	0.57
Degree	14.6	17.1	14.3	0.461	0.034	0.79
Trade Qualification	40.2	38.3	33.9	0.608	0.039	0.73

Significant differences were observed in the relative proportions of game fishing club members within the three specialisation clusters (advanced = 52.4%, intermediate = 11.3%, casual = 8.5%): X^2 (2, n = 406) = 73.343, p = 0.000. The results demonstrate an obvious pattern of increasing club membership with specialisation level. However, the difference between advanced and intermediate anglers was considerably greater than the difference between intermediate anglers and occasional anglers.

Species preference

Significant differences between specialisation groups were observed for all species except yellowfin tuna (Table 4.6). A pattern of increasing preference from advanced to occasional anglers was observed for albacore tuna: the opposite pattern was seen for southern bluefin tuna and striped marlin, where they were increasingly preferred by more specialised anglers. Interestingly, mako shark were similarly preferred by advanced and occasional anglers, but less preferred by intermediate anglers.

Table 4.6. A comparison of species preference among three specialisation categories of anglers

	% Advanced (n = 81)	% Intermediate (n = 247)	% Casual (n = 53)	X^2	phi	sig.
Albacore tuna	11.1	38.9	45.3	24.571	0.254	0.000
Bluefin tuna	37.0	27.9	17.0	6.403	0.131	0.041
Yellowfin tuna	25.9	23.5	18.9	0.897	0.049	0.638
Mako shark	18.5	8.9	18.9	7.640	0.142	0.022
Striped marlin	7.4	0.8[a]	0[a]	14.237	0.193	0.001

[a]Cells have counts less than the minimum expected count

Social participation

Overall, friends were the most frequent fishing companions for all three groups. No significant differences were observed for the frequency by which differently specialised respondents fished with friends or family members. However, as expected, advanced fishers indicated fishing with fishing club members significantly more often than intermediate and occasional fishers.

Table 4.7. One-way ANOVA tests for mean differences in game fishing frequency with five social groups according to specialisation level.

	Advanced (n = 82)	Intermediate (n = 265)	Occasional (n = 59)	F	p
By Yourself	1.27	1.27	1.26	0.150	0.985
With Friends	3.06	2.91	2.98	0.730	0.438
With Family	2.58	2.38	2.35	1.239	0.291
With Friends and Family Together	2.53	2.53	2.19	2.362	0.096
With Fishing Club Members	1.58[a]	1.36[b]	1.26[b]	3.799	0.023

Mean scores for all items were based on responses to the following categories; 1 = Never, 2 = Sometimes, 3 = Often, 4 = Always

Different superscripts indicate significant difference

Motivations

For all specialisation groups, the majority of motivational items were endorsed as being of at least moderate importance (Table 4.8). This endorsement was demonstrated by mean item scores higher than the middle value of the scale (i.e. 3) for 16 of the 20 items for advanced fishers, and 15 items for intermediate and occasional fishers. Non-catch related items were ranked more highly; only advanced and occasional fishers had a catch-related item ranked within their top five ranked items. For all angler groups, the items 'for relaxation' and 'to be outdoors' were ranked within their top five. The items 'for the experience of catching fish' and 'to catch a trophy fish' were the highest and lowest ranked catch-related items for all angler groups, respectively. Furthermore, advanced fishers had a considerably higher aggregated total for all items, suggesting that they were more highly motivated to participate than intermediate and occasional fishers.

For non-catch related fishing motivations, only three items revealed significant differences between angling groups. Occasional fishers rated the

item 'to experience adventure and excitement' more highly than intermediate anglers. Advanced anglers rated 'to be close to the water' as significantly more important than intermediate and occasional anglers. While the other two items in the *Natural Environment* category appear very similar in scope, no significant differences were identified. Intermediate anglers rated family recreation as a motivating factor to be significantly more important than casual anglers.

For catch-related motivations, significant differences between the angling groups were observed for five items: four of these items were in the *Fishery Resource* category. For the item 'to obtain fish to eat', occasional anglers rated the item as less important than both intermediate and advanced anglers. Advanced anglers placed significantly greater importance on catching trophy fish than intermediate anglers; the trend, however, did not extend to the least specialised group. Advanced anglers also rated the items 'for the experience of catching fish' and 'for challenge or sport' higher than intermediate anglers but not occasional anglers. In the *Miscellaneous* category, only the item 'to participate in competition' revealed significant differences between groups; advanced anglers rating this item as significantly more important than the other two groups.

Table 4.8. One-way ANOVA tests for mean differences in importance of motivational items according to specialisation level

	Advanced (n = 82) Mean (± SD)	Intermediate (n = 265) Mean (±SD)	Occasional (n = 59) Mean (±SD)	F	p
Excitement and Adventure (α = 0.507)					
To experience new and different things	3.39 (1.13)	3.49 (0.99)	3.41 (1.10)	0.36	0.696
To experience adventure and excitement	3.70 (1.05)	3.47 (1.05)[a]	3.81 (1.01)[b]	3.52	0.031
Escape and Relaxation (α = 0.478)					
To get away from the regular routine	3.60 (1.03)	3.62 (1.16)	3.68 (1.14)	0.09	0.915
For relaxation	4.23 (0.76)	4.13 (0.77)	4.29 (0.77)	1.25	0.287
To get away from the demands of other people	3.41 (1.25)	3.27 (1.36)	3.47 (1.33)	0.79	0.456
Natural Environment (α = 0.657)					
To be outdoors	3.93 (0.94)	3.87 (0.92)	3.88 (0.85)	0.13	0.876
To experience unpolluted natural surroundings	3.77 (1.06)	3.73 (1.11)	3.90 (1.14)	0.58	0.559
To be close to the water	4.04 (0.96)[a]	3.68 (1.05)[b]	3.56 (1.06)[b]	4.73	0.009
Social (α = 0.338)					
For family recreation	3.54 (1.07)	3.52 (1.15)[a]	3.12 (1.15)[b]	3.22	0.041
To be with friends	3.96 (0.78)	3.79 (0.95)	3.76 (0.94)	1.27	0.283
Mean Item Score for Non-catch Items	**3.78 (0.99)**	**3.65 (1.05)**	**3.66 (1.04)**		
Fishery Resource (α = 0.661)					
To obtain fish to eat	3.49 (1.05)[b]	3.43 (1.15)[b]	3.02 (1.19)[a]	3.41	0.034
For the experience of catching fish	3.99 (0.94)[a]	3.62 (1.05)[b]	3.81 (0.90)	4.32	0.014
To catch a trophy fish	2.93 (1.25)[a]	2.39 (1.30)[b]	2.85 (1.29)	7.18	0.001
For challenge or sport	3.60 (1.05)	3.12 (1.21)	3.36 (1.20)	5.39	0.005
To fish where it is not difficult to catch fish	2.41 (1.08)	2.39 (1.13)	2.54 (1.02)	0.32	0.636
Skills and Equipment (α = 0.635)					
To develop my fishing skills	3.51 (1.05)	3.24 (1.10)	3.22 (1.10)	2.13	0.120
To test my fishing gear	2.80 (1.06)	2.59 (1.22)	2.54 (1.21)	0.86	0.284
Mean Item Score for Catch Related Items	**3.24 (1.07)**	**2.96 (1.17)**	**3.04 (1.13)**		
Miscellaneous					
To participate in competition	2.27 (1.26)[a]	1.62 (0.95)[b]	1.74 (1.03)[b]	12.22	0.000
Due to reports of good fish availability	2.75 (1.10)	2.49 (1.17)	2.68 (1.17)	1.89	0.151
Due to reports of good weather conditions	3.72 (1.14)	3.69 (1.12)	3.65 (1.19)	0.06	0.942
Total Mean	**3.46 (1.05)**	**3.23 (1.10)**	**3.28 (1.09)**		

Mean scores for all items were based on responses to the following response categories; 5 = Extremely Important, 4 = Important, 3 = Moderately Important, 2 = Slightly Important, 1 = Not at all Important

Values in parentheses following category titles are Cronbach alpha reliability scores

Different superscripts indicate significant difference

Consumptive orientation

Overall, the three specialisation groups were similar in their consumptive orientation. Mean index scores for domains suggest that in descending order of importance, respondents expressed greatest orientation to catching large/trophy fish, catching numbers of fish, catching fish (as a measure of success and/or satisfaction), and retaining fish. Mean index scores also

suggest that catching large/trophy fish was the only domain endorsed by all groups to be of at least moderate importance. In fact, for all specialisation groups, three of the four highest ranked items among all domains rated to catching large/trophy fish. A summary of the consumptive orientation results would suggest that none of the groups were reliant on fish capture for a satisfying trip, preferred catching large fish to catching lots of fish and were not compelled to retain fish. Responses to the two items pertaining to releasing fish suggests that fishers, in general, do not want to retain all fish, but find it somewhat important to be able to retain some fish.

The results illustrate a lack of significance between specialisation level and consumptive orientation for all categories except 'attitudes to catching large/trophy fish' (Table 4.9). Here, significance was observed at the index level and for three items. Of the former, advanced fishers attached greater importance to catching large fish than intermediate fishers. At the item level, significant differences were observed between advanced and intermediate fishers for two items – 'I would rather catch 1 or 2 big fish than 10 smaller fish' and 'I like to fish where I know I may catch a trophy fish'. For the third significant related item, advanced and occasional fishers expressed a level of agreement with the item 'I'm happiest when I catch a challenging fish' greater than that expressed by intermediate fishers.

For the additional item to the four dimensional model, advanced anglers offered significantly less agreement with the statement "It doesn't matter to me what type of fish I catch" than did intermediate anglers. This finding suggests that advanced fishers were more selective of their target species; however, the level of significance was not strong.

Table 4.9. One-way ANOVA tests for mean differences in consumptive orientation items according to angler specialisation level.

Consumptive Orientation Domains and Items	Advanced (n = 82) Mean (±SD)	Intermediate (n = 265) Mean (±SD)	Occasional (n = 59) Mean (±SD)	F	p
Attitudes To Catching Fish (α = 0.77)					
A fishing trip can be successful even if no fish are caught	2.12 (1.13)	2.19 (0.99)	2.22 (1.15)	0.19	0.824
I'm just as happy if I don't catch a fish	2.93 (1.16)	2.94 (1.04)	2.83 (1.13)	0.26	0.770
If I thought I would not catch a fish I would not go fishing	2.94 (1.35)	2.69 (1.22)	2.80 (1.32)	1.23	0.294
I'm not satisfied unless I catch at least something	3.05 (1.09)	2.88 (1.17)	2.95 (1.07)	0.72	0.487
Domain Index Mean	**2.76 (0.89)**	**2.68 (0.84)**	**2.70 (0.93)**	**0.24**	**0.784**
Attitudes To Catching Numbers of Fish (α = 0.72)					
The more fish I catch the happier I am	3.04 (1.16)	2.92 (1.07)	2.80 (1.05)	0.85	0.429
A successful fishing trip is one where many fish are caught	2.82 (1.16)	2.81 (1.04)	2.69 (1.19)	0.30	0.741
Domain Index Mean	**2.93 (0.99)**	**2.88 (0.94)**	**2.75 (0.96)**	**0.63**	**0.531**
Attitude to Catching Large/Trophy Fish (α = 0.66)					
I would rather catch 1 or 2 big fish than 10 smaller fish	4.00 (1.02)[a]	3.63 (0.98)[b]	3.68 (1.07)	4.23	0.015
The bigger the fish I catch the better the fishing trip	3.28 (1.14)	3.16 (1.04)	3.38 (0.93)	1.29	0.274
I'm happiest when I catch a challenging fish	4.27 (0.88)[b]	4.04 (0.84)[a]	4.29 (0.59)[b]	3.92	0.021
I like to fish where I know I may catch a trophy fish	3.29 (1.21)[a]	2.91 (1.13)[b]	3.08 (1.07)	3.69	0.026
Domain Index Mean	**3.71 (0.78)[a]**	**3.43 (0.70)[b]**	**3.61 (0.71)**	**5.41**	**0.005**
Attitude to Retaining Fish (α = 0.67)*					
I'm just as happy if I release the fish I catch	2.40 (0.94)	2.61 (1.02)	2.66 (0.94)	1.59	0.205
I want to keep all the fish I catch	2.05 (0.95)	2.18 (0.96)	2.03 (0.89)	0.99	0.370
Domain Index Mean*	**2.23 (0.79)**	**2.40 (0.65)**	**2.35 (0.58)**	**1.59**	**0.203**
Additional Item					
It doesn't matter to me what type of fish I catch	2.79 (1.09)[a]	3.15 (1.06)[b]	3.10 (0.98)	3.62	0.028
Total Mean	2.91 (0.86)	2.85 (0.78)	2.85 (0.80)		

Items 1,2 and 12 were reverse coded for consistency with other items within the same category

Mean scores are based on levels of agreement to attitudinal statements (items) pertaining to each category. Attitudinal statements were coded as follows: 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree

Different superscripts indicate significant difference

Values in parentheses following domain titles are Cronbach's alpha reliability scores

* The item "I usually eat the fish I catch" was omitted from the index to improve reliability

Conservation orientation

For both measures of conservation orientation, the results demonstrated significant differences between the three specialisation groups; a distinct pattern of increasing conservation orientation with specialisation was observed (Table 4.10).

Table 4.10. A comparison of proportions of conservation oriented anglers between three specialisation categories of anglers

Category	% Advanced (n = 82)	% Intermediate (n = 265)	% Occasional (n = 59)	X^2	phi	Sig.
Conservation Orientation #1[a]	70.7	55.5	42.4	11.688	0.171	0.003
Conservation Orientation #2[b]	37.8	18.1	8.5	21.075	0.228	0.000

[a] Respondents acknowledged the need to sustain fish stocks and/or preserve the aquatic environment

[b] Respondents acknowledged the impact of recreational fishing on game species viability

Management preferences

For all angler groups, mean agreement levels above the mid-range scale value (3) for all but one item suggests an overall level of support for the proposed management options and initiatives (Table 4.11). The promotion of catch and release fishing, and mandatory catch and release for SBT, received the strongest and weakest support, respectively among all groups. The only significant difference between specialisation groups was for the proposal of 'a personal combined bag limit of 1 mako shark or blue shark'. Here, intermediate fishers were more in favour of this proposal than occasional respondents.

Table 4.11. One-way ANOVA tests for mean differences in agreement level to proposed management changes and initiatives according to angler specialisation level.

Management Scenario	Advanced (n = 82) Mean (±SD)	Intermediate (n = 265) Mean (±SD)	Occasional (n = 59) Mean (±SD)	F	p
SBT to be catch and release only	2.35 (1.22)	2.38 (1.08)	2.25 (1.17)	0.32	0.720
Striped marlin to be catch and release only	3.14 (1.35)	3.25 (1.26)	3.25 (1.35)	0.25	0.781
A personal combined bag limit of 1 SBT or YT	3.06 (1.40)	3.25 (1.29)	3.12 (1.29)	0.71	0.488
A personal combined bag limit of 1 MS or BS	3.59 (1.18)	3.69 (1.09)[a]	3.29 (1.20)[b]	3.12	0.045
Game fish possession limits for boats	3.64 (1.11)	3.78 (1.06)	3.58 (1.03)	1.16	0.315
A personal bag limit of 5 albacore tuna[1]	3.32 (1.33)	3.65 (1.12)	3.37 (1.23)	3.11	0.065
A minimum size limit for albacore tuna	3.56 (1.24)	3.58 (1.09)	3.56 (1.19)	0.01	0.991
The promotion of catch and release fishing[1]	3.91 (0.94)	3.72 (1.04)	3.73 (1.16)	1.09	0.348
The promotion of tag and release fishing	3.81 (0.96)	3.64 (1.03)	3.68 (1.14)	0.82	0.442

Standard deviation scores are in parenthesis

SBT = southern bluefin tuna, YT = yellowfin tuna, MS = mako shark, BS = blue shark

Mean scores are based on levels of agreement. Attitudinal statements were coded as follows: 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree

[1]Brown-Forsythe tests were used to obtain significance values due to violation of Levene's tests for homogeneity of variances

Common superscripts indicate significant difference

4.6 Discussion

Principal component analysis revealed that the items used to represent three dimensions of specialisation (i.e. behaviour, skills and knowledge, and commitment) were successful in measuring the same latent construct. The relationship between the items provides additional support for the three dimensional approach recommended by Scott and Shafer (2001) and subsequently used by Lee and Scott (2004), Oh *et al.* (2005), and Oh and Ditton (2006; 2008). The observation of numerous significant differences between differently specialised groups, many of which were predicted by specialisation theory or results from empirical studies, provides further support for the three dimensional approach and the decision to segment the specialisation continuum using three clusters.

While the results demonstrated numerous differences between specialisation groups, a considerable number of differences were observed between two groups only. Most of these were between advanced and intermediate fishers and included catch related motivations and attitudes to catching trophy fish. This pattern was also apparent for the majority of significant chi-square tests (e.g. income, club membership, species preference, conservation orientation) whereby differences in proportional values between advanced and intermediate fishers were considerably greater than between intermediate and occasional fishers. These observations were somewhat proportionate to the greater difference in mean specialisation index item values observed between these two groups than were observed between intermediate and occasional fishers. While these observations were influenced by the decision to use three cluster groups, they also suggest that differences in anglers attitudes, behaviour, motivations and orientations were more acute towards the more specialised end of the 'specialisation continuum'. This observation is consistent with Bryan (2000: 20) who, in a retrospective evaluation of the specialisation concept, noted that "theoretical applications of specialisation are significant at the high end of the continuum".

In Bryan's (1977) original conceptualisation of specialisation, the continuum was described as a linear progression that would naturally parallel anglers experience; however, Fisher (1997) and Scott and Shafer (2001) suggested that the 'continuum' is inherently discrete and non-linear. Furthermore, Ditton *et al.* (1992: 39) reconceptualised specialisation as "a process by which social worlds and sub-worlds segment and intersect into new recreation sub-worlds". Accordingly, it is entirely plausible that anglers' attitudes, behaviour, motivations and orientations will not move in a linear fashion with experience and other measurements of specialisation, and such findings further underscore the value of a comprehensive multivariate approach to measuring specialisation.

4.6.1 Assessing the number and size of angler specialisation groups

Cluster analysis provided justification for the use of two to five angler groups. Three groups were chosen in preference to a higher number to ensure group sizes were sufficient to facilitate meaningful comparisons. Three groups were also chosen to enhance managerial relevance, to enable comparisons with other studies (Hvengaard, 2002; Oh *et al.* 2005; Oh and Ditton, 2006) and to assist in applying the 'three stages of involvement' framework developed by Bryan (1977; 1979) to interpret the results. This framework suggests that the evolution of involvement in outdoor activities may be characterised by three stages – novice, established and specialised. For the current study, these stages may be analogous to occasional, intermediate and advanced anglers, respectively. According to Bryan (1979), during the novice stage, recreationists are likely to participate infrequently and are focused on getting results. During the establishment stage, participation has become an established behaviour and participants have developed competency in the activity; they attempt to validate their competency by seeking greater challenges. As specialised recreationists, individuals demonstrate a high degree of participation, commitment and activity-related knowledge and skills. According to Bryan (1979: 88), they also "centre much of their lives and identities around their sports or hobbies". Bryan also stressed that the three stages he described are abstractions only and noted that it is often not

possible to assign a precise beginning or end point to a particular stage. Furthermore, the interpretation of stages of involvement will be influenced by the degree of complexity that characterises a particular activity.

The recognition that different activities differ in complexity also provides a starting point in which to evaluate the sizes of the respective specialisation groups. Bryan (1979: 91) suggested that the number of outdoor activity participants is "skewed towards the lower end of the continuum" due to the considerable time, effort and money required to attain specialised status. It is therefore reasonable to assume that a higher proportion of less specialised participants would be even more apparent for more complex activities. Compared to many other angling types, game fishing could be viewed as having large scope for complexity due to the considerable time and financial investments required, the advantages of understanding complex fishery-based information (e.g. oceanography, environmental preferences and migrational patterns of fish), skills required in locating, hooking and playing large fish and the variety of fish species that provide different utility for anglers of different specialisation levels.

However, the relative proportions of differently specialised fishers in this study cannot be viewed as representative of specialisation within the Tasmanian game fishery for three reasons. First, the determination of group sizes was influenced by the number of cluster groups chosen. As the decision was made, to a degree arbitrarily, a determination to use a different number of groups would have resulted in different numbers of individuals within each group.

Second, results were probably affected by sampling bias issues. The distribution of questionnaires to private boat fishers who were boat owners *only* excluded individuals who did not own their own boats. Boat owners are likely to be more specialised than non-boat owners due to the financial commitment required, and consequently a survey design incorporating non boat owners would plausibly yield a greater proportion of lesser specialised anglers. For charter boat fishers, the intention that charter boat operators

would distribute questionnaires to every client on every trip would have alleviated sampling bias. However, for many charter boat operators involved in the survey, it appears that questionnaires were not distributed on every trip (see Chapter 3). Accordingly, the chances of receiving a questionnaire would have increased for more avid fishers. The probable effects of sampling bias in under-representing less specialised individuals has also been recognized by other authors (Salz *et al.* 2001; Oh *et al.* 2005; Salz and Loomis, 2005).

Third, the effects of non-response bias would probably also over-estimate the percentage of more specialised respondents. Various authors have observed that people with a high level of interest in the subject matter of a survey are more likely to respond (Brown *et al.* 1981; Choi *et al.* 1992; Fisher, 1997). This insight suggests that the response to this survey would probably be biased towards more specialised fishers. Such tendencies are difficult to avoid, especially when using a long and detailed survey instrument. Furthermore, without a sampling frame (i.e. a fishing licence database), it is very difficult to correct for non-response bias. The likely impact of these biases on relative group sizes should, however have minimal impacts on differences observed between groups, given that sample sizes of each of the groups were sufficiently large to generate statistically meaningful results.

4.6.2 Comparing specialisation groups with variable classes

Some of the results accord with specialisation theory and results from other studies, while other results imply mediation by specialisation peculiar to the Tasmanian game fishery. The observation of numerous differences suggests that the clustering solution chosen was successful in disaggregating differently specialised groups, which were in turn successful in identifying relationships with a range of variables. Perhaps most importantly in the context of this study, the results demonstrated that more specialised anglers were more highly represented among private boat respondents. Results that were consistent with previous studies related to club membership, species preference, frequency of fishing with fishing club members, conservation orientation, activity-general motivations, attitudes to catching large/trophy

fish and attitude to catching a particular type of fish. Results that were not consistent with theoretical or empirical studies related to age, frequency of fishing with family members and/or friends, activity-specific motivations, attitudes to catching fish, attitudes to catching numbers of fish, attitudes to retaining fish and attitudes to restrictive regulations.

Bryan's (1979) suggestion that socio-demographic status could mediate specialisation received support in relation to club membership and income, but not for age, education level or employment status. While the greater likelihood of fishing club members among more specialised fishers has been well established in other studies (Chipman and Helfrich, 1988; Gigliotti and Peyton, 1993; Fisher, 1997; Oh *et al.* 2005; Oh and Ditton, 2006), the literature pertaining to income is less so. However, the higher incomes of the most specialised group are consistent with a suggestion by Chipman and Helfrich (1988) that income levels may prevent some fishers from attaining a highly specialised status. Accordingly, a 'specialisation bottleneck' may exist whereby anglers on lower incomes face financial barriers to becoming more specialised. Such a barrier has the potential to restrict individuals' capacity to fish more often. Furthermore, a lower income may prevent individuals from purchasing boats and associated fishing equipment suitable for game fishing, which would, in turn restrict the amount of fishing effort required to attain specialised status. Such a scenario is plausible for any recreational activity where considerable expenses are involved. Where alternatives to owning the equipment necessary to participate exist, such as for the Tasmanian game fishery (i.e. participants may use charter services and/or fish from friend's boats), participants with lower incomes will likely face restraints from participating at a desired level. For activities where no alternatives are evident, a low discretionary income may prevent participation altogether.

The results for conservation orientation and management preferences and initiatives appeared counter-intuitive. Advanced anglers demonstrated a greater awareness of game fish sustainability issues and a concern for the impact of recreational fishers on game fish stocks. However, this concern was not manifest as greater support for more restrictive regulations or initiatives

than that expressed by lesser specialised fishers. The results for conservation orientation were consistent with specialisation theory (Bryan, 1977; Ditton *et al.* 1992) and supporting studies (Fisher, 1997; Oh and Ditton, 2008). However, specialisation theory also suggests that more specialised individuals will offer greater support for regulations and initiatives designed to protect the resource in question (Ditton *et al.* 1992). Nonetheless, three other studies have observed levels of support for restrictions (marine protected areas and closed fishing seasons) by highly specialised fishers that were less than or not different from levels of support from lesser specialised fishers (Chipman and Helfrich, 1988; Salz *et al.* 2001a; Salz and Loomis, 2005). In explaining the results from these studies, Salz and Loomis (2005) pointed to specialisation theory, suggesting that as specialisation levels increase, dependence on 'specific resources' will also increase (Bryan, 1977; Ditton *et al.* 1992); therefore, the relationship between specialisation and support for traditional regulations (i.e. bag limits and size limits) may not apply for regulations restricting spatial or temporal access to fishing activity. As the majority of the proposed regulations and initiatives in the current study related to 'traditional regulations', this rationale may not be applicable in explaining all the results. However, the rationale may be extended to two of the propositions relating to mandatory catch and release for SBT and striped marlin. It could be reasonably argued that the opportunity to retain a fish may be viewed as a 'specific resource' on which more specialised fishers are dependent. Nonetheless, in view of the results for the 'traditional regulations', other explanations for the results are offered.

Such apparently incongruent results may be better understood by considering anglers' attitudes to ownership and responsibility relating to fish conservation, which may mediate the relationship between conservation orientation and support for more restrictive measures. Based on the conceptualisation by Bryan (1977), it is reasonable to assume that more specialised anglers would likely possess a greater understanding of the biology and management of fish populations, which would further likely manifest as attitudes and feelings of responsibility and custodianship toward the resource. However, these attitudes and feelings may be eroded by the understanding that most game fish species

are transitory, migrate internationally and are exploited in many jurisdictions; some game species may be perceived to be less well managed than within local jurisdictions. As a result, anglers may feel that any attempts to sustain the resource by local measures may be futile or have negligible impacts. Such a phenomenon could be better understood using a multi-faceted approach to measuring conservation orientation endorsed by Newhouse (1990) or Tarrant and Green (1999). Newhouse identified diverse variables associated with conservation-related behaviours that may also be used in depicting one's conservation orientation. These were knowledge of the issue/s, locus of control (that is, an individual's perception of his or her ability to create change by modifying behaviour) and personal responsibility (i.e., an individual's sense of obligation). Future research on the conservation orientation of recreational fishers may consider incorporating variables of this nature to garner a more nuanced understanding of anglers and aid the interpretation of anglers' attitudes to conservation measures.

The results for motivational items accorded with numerous studies suggesting that angler motivations and satisfactions are complex and require the interaction of catch and non-catch factors (Ditton *et al.* 1978; Spencer, 1993; Fedler and Ditton, 1994; Calvert, 2002). Also consistent with previous research (i.e. Ditton *et al.* 1978; Dawson and Wilkins 1981; Fedler and Ditton, 1994; Wright and Sanyal, 1998; Ormsby and Innes, 1999) was the greater level of importance attributed to items unrelated to catch. The endorsement of almost all items by all groups was furthermore consistent with Fedler and Ditton (1994) who have observed a tendency for anglers targeting large fish to rate most motive items higher than fishers targeting smaller species.

The results indicate that all activity-general motivations were important for all specialisation groups. However, there was insufficient evidence of a progression from activity-specific motivations to activity-general motivations along the specialisation continuum, as suggested by Bryan (1977) and Ditton *et al.* (1992). Aggregated mean values for both types of motivations indicate that advanced fishers were more highly motivated by both catch *and* non-catch factors. While the latter observation is consistent with specialisation

theory (Bryan, 1977; Ditton *et al.* 1992), the former observation is not. The high importance placed on catch related motivations among advanced fishers was further reflected in higher aggregate mean consumptive orientation totals for this group. At an aggregate level, a positive relationship between specialisation and motivational categories has also been observed by Oh and Ditton (2008) and Salz *et al.* (2001b). For the latter study, this pattern was evident across three saltwater angling modes – private boat fishers, party boat fishers and shore-based fishers. It is therefore apparent that specialisation theory pertaining to catch motivations may not be applicable to many recreational fisheries and may require re-conceptualisation before generalisations can be made between fisheries. As discussed earlier, questionable methodologies used by researchers (Ditton *et al.* 1992; Salz *et al.* 2001a) to validate this aspect of specialisation theory further support this assertion. Furthermore, even more variability is imparted by the observation that catch-related motivations may be affected by anglers' successes in capturing their preferred size, number or species of fish on previous fishing trips (Finn and Loomis, 2001), obscuring the supposed link between motivations and specialisation.

The three specialisation groups were quite similar in their consumptive orientation. In descending order of importance, respondents within all groups expressed greatest orientation to catching large/trophy fish, catching numbers of fish, catching fish (as a measure of success and/or satisfaction), and retaining fish. A strong orientation to catching large/trophy fish was also observed among Atlantic bluefin tuna fishers (Sutton and Ditton, 2001) and is intuitive in light of the characteristics of fishing for game species. Anglers' orientation to catching large/trophy fish was, however, the only domain where significant differences were observed between angler groups; advanced fishers expressed greatest orientation to this domain. This insight was further supported by species preference results demonstrating a relationship between specialisation and a preference for larger species, namely SBT and striped marlin. Combined, these results are consistent with specialisation theory (Bryan, 1977) which suggests that anglers will seek more elusive challenges and rewards as they become increasingly specialised. Nonetheless, these

results, and the results for the motivational item 'to catch a trophy fish' suggest that differences in orientation were between advanced and intermediate fishers only: Values for occasional anglers were in-between those of advanced and intermediate anglers. While reasons for this observation are not clear, it is possible that least specialised anglers may not have properly defined their orientation to the fishery. As such, they may be attracted to game fishing by the idea of catching large and challenging fish from a naïve and simplistic perspective. Conversely, more experienced intermediate anglers will be more familiar with game fishing, and consequently more realistic about the fishery and their personal limitations.

Contrary to the expectation that less specialised fishers would express a greater level of agreement with consumptive items relating to retaining fish, no differences were observed between angler groups. However, advanced and intermediate fishers expressed greater agreement with the motivational item "to obtain fish to eat" than occasional fishers. These apparent inconsistencies may be explained by close inspection of the wording of both items used to measure orientation to retaining fish – "I'm just as happy if I release the fish I catch" and 'I want to keep all the fish I catch". The items appear to be focused on assessing whether anglers either retain *or* release fish. In contrast, the motivational item "to obtain fish to eat" does not infer a mutually exclusive decision between releasing or retaining fish. In practical terms, anglers often retain a portion of their catch irrespective of their level of specialisation. It is likely therefore that any differences in an angler's orientation to fish retention will lie in the ratio of retained to released fish. While the consumptive orientation scale items used in this study have also been used in previous studies, future studies of recreational fishers should consider modifying index items to allow individuals to express the proportion of fish they generally retain, and under what circumstances this may change. Such an approach may facilitate a more nuanced understanding of fishers' orientation to fish retention than the consumptive orientation items generally used.

Despite inconsistencies between consumptive orientation and motivational results, neither is supportive of specialisation theory and the majority of

related studies demonstrate an inverse relationship between fish retention and angler specialisation. However, Salz *et al.* (2001b) have observed a greater orientation to retaining fish by more specialised fishers across three saltwater fishing modes – private boat, party boat and shore-based fishers. Therefore, the results suggest that the orientation to retaining and releasing fish by differently specialised fishers is not uniform across fisheries, despite receiving support from the bulk of empirical studies. Salz and Loomis (2005) contend that unlike trout and bass fisheries, where there is an established tradition of catch and release fishing, voluntary catch and release is rarely practiced in many saltwater fisheries, regardless of specialisation level. While fish are voluntarily released by Tasmanian game fishers (see Chapter 5), it is likely that the culture of catch and release fishing is not as firmly entrenched as in other fisheries, including in other game fisheries.

4.6.3 Conclusions and recommendations for further research

The large number of significant differences between fisher groups suggests that recreational specialisation was effective in exploring heterogeneity among Tasmanian game fishers. While many of these differences were consistent with a growing consensus on specialisation based relationships, other results suggest that some fundamental relationships underpinning the recreational specialisation concept may not be applicable to Tasmanian game fishers. Similarly 'discrepant' results from other authors coupled with questionable methodologies used in other studies to verify some of the specialisation mediated relationships proposed by Bryan (1977; 1979) suggest that future development and application of the concept would benefit from work on contextualising these relationships. In other words, it may be insightful to understand the social, cultural, economic and managerial context in which commonly accepted relationships proposed by landmark studies may or may not be applicable. Furthermore, and perhaps most importantly, the recreational specialisation concept could be advanced by understanding the context provided by the idiosyncratic nature afforded by different target species.

It is useful at this point to recall that the recreational specialisation concept, as it applies to recreational fishers, was developed in reference to trout anglers. Accordingly, identifying specialisation is rooted in the vagaries of this study population, which may or may not have immediate relevance to other fishing populations. Among trout fishers, ample scope for specialisation is provided by the well understood adoption of the catch and release ethos, the clear differentiation between methods used - i.e. bait, lure and fly – (which require different levels of skill to exercise effectively), and the progression between different methods over many fishers' angling careers. In contrast, the limited degree of variability among behaviours and attitudes of fishers targeting many other species (or species types) provides a relatively constrained scope in which specialisation may be demonstrated and identified. Consequently, other factors peculiar to a fishing population may be more accurate demonstrations of one's specialisation status. In the present study, the distinction between fishers who had purchased the equipment required to fish independently, and target species preference, were two clear examples.

Recognising that the recreational specialisation concept was developed among trout fishers may also help contextualise fundamental deviations from some of the relationships proposed by earlier studies that were observed in the current study (and from some related studies). These relationships pertained to attitudes to restrictive management options, consumptive orientation, and the assumed progression from catch to non-catch fishing motivations with specialisation. While explanations for the deviations observed in this study have already been offered for each of these, additional insights may be offered by exploring the commonalities between all three. In particular, the 'traditional' understanding that underpins all three areas of study assumes that, as fishers become more specialised, their focus shifts from catching and harvesting fish to minimising their impact on fish populations and developing a greater affinity with aspects of the fishing experience that are separate from catching and harvesting fish. When comparing the current study population with trout fishers, differences are apparent in the relationship between fish and fisher. Perhaps most importantly, the cause and effect relationship between exploitation and population level effects are more palpable in fisheries devoid

of a commercial fishing sector i.e. the fisher may acknowledge that recreational fishers are wholly responsible for exploitation within a fishery. Popular literature on freshwater fishing, especially trout fishing, is replete with examples of romanticised accounts of the intimate relationship between fish and fisher – these accounts often involve anglers developing an understanding and appreciation of the behaviour of individual fish residing in a stretch of river or lake. Accordingly, these observations may engender feelings of custodianship toward the resource. By contrast, the presence of game species in Tasmanian waters is an ephemeral phenomenon, and most fishers are likely to be mindful that fish are exploited by both recreational and commercial fishers in jurisdictions outside Tasmanian waters. Indeed, the mismatch between conservation orientation and both consumptive motivations and attitudes to management suggests that the cause and effect relationship between exploitation and population level effects are somewhat confounded by perceptions of scale and accountability.

The explanation provided above has clear implications for fisheries beyond the Tasmanian game fishery, and warrants further research. If the relationships between consumptive attitudes/motivations/orientation and perceptions of scale, accountability, control and custodianship are clarified in a manner that transcends individual fisheries, a reconceptualisation of some of the fundamental relationships underpinning specialisation will be necessary. It will also be an important step in advancing the specialisation concept by providing a contextual framework in which it may be more effectively understood and applied.

Another area of research that may also inform a reconceptualisation of fisher specialisation in a contextual manner pertains to the relationship between specialisation and the importance placed on non-catch motivations. As outlined earlier, it is likely that the assumed progression from catch to non-catch motivations with specialisation will be mediated by the scope afforded by non-catch aspects evident within a particular fishery. Clearly, the method of capture and the environment in which fishing is undertaken may be more or less conducive to non-catch factors of the fishing experience, and

consequently, non-catch motivations. Returning to the trout fishing example, the ability to explore natural environments, including wilderness areas (and the additional leisure activities that may be derived therein) clearly offers greater scope for non-catch related experiences pertaining to natural environment appreciation and solitude than bluewater fishing, regardless of specialisation level.

4.6.4 Use of specialisation indices in future studies

In future, researchers may benefit from considering a greater number of variables as items to represent behaviour, skills and knowledge and commitment. The specialisation literature appears to be increasingly oriented to the use of more comprehensive indices in recognition of their greater capacity to encapsulate the complexities of a multi-dimensional concept such as specialisation. While specialisation theory suggests that items and components within an index should be mutually reinforcing, Scott and Shafer (2001) acknowledge that commitment, behaviour and skills and knowledge may not necessarily move in a sequential or linear manner. For example, individuals may differ in their desire or ability to acquire greater skills and knowledge in line with participation frequency. Therefore, a greater number of carefully considered variables should improve the effectiveness and validity of the index. A more comprehensive index should also have a greater capacity to maintain scale integrity if items are removed due to poor compatability with other items. In the following sections, recommendations will be made regarding each of the three specialisation sub-dimensions.

Behaviour

While it is relatively straightforward to measure angler's avidity, or frequency of participation in fishing within a defined period, assessing one's experience is more problematic. A common approach is to ask fishers for their number of year's participation/experience. Generally speaking, this type of questioning is either interpreted as the total number of years between the commencement of the activity and time of survey *or* the estimated number of years where participation has occurred between these two points in time. Even if the

question is refined to eliminate the ambiguity, responses are not an accurate assessment of the extent of one's participation; that is, a year incorporating one fishing trip is indistinguishable from a year incorporating twenty fishing trips. Accordingly, the item 'number of species' was used in this survey, its deployment rooted in the assumption of a positive relationship between the time spent fishing and the opportunity of catching a 'new' species. While the high factor loading for this item indicated its close relationship with other variables measuring specialisation, it may under-represent specialised fishers who target particular species only. Therefore a question asking fishers for an estimation of the number of trips taken during their lifetime should be considered in future studies. While responses would be subject to considerable recall bias, especially for more experienced fishers, bias issues would likely be less apparent than for the 'standard' approach of measuring experience.

Commitment

Recreationists' orientation to commitment is likely to be expressed in very different ways depending on the nature of the activity (Scott and Shafer, 2001). Consistent with previous angling studies (i.e. Chipman and Helfrich, 1988; Oh *et al.* 2005; Oh and Ditton 2006; 2008) the monetary value of game fishing gear could be successfully used as a measure of behavioural commitment. Compared to many other types of fishing, equipment required for game fishing is expensive and technically sophisticated, providing a large degree of scope for the potential use of the item. It is therefore reasonable to assume that more specialised anglers would express their commitment to game fishing by investing in expensive equipment. At the other end of the spectrum, less specialised game fishers may use inferior equipment, borrow equipment or use equipment provided by charter boat operators.

According to Scott and Shafer (2001) the commitment dimension of recreational fishing may be viewed in terms of both behavioural and personal commitment. In light of this view, it would be prudent to consider measures of personal commitment in a balanced index. This consideration could be addressed by re-wording and testing the item 'importance of game fishing' to address the issues previously outlined. In addition, questions could be

formulated to measure participant engagement in behaviours that promote the interests of the activity (Scott and Shafer, 2001) such as tagging studies.

Skills and knowledge

In line with most specialisation related angler studies, this study did not address the knowledge aspect of the skills and knowledge dimension. One exception to that tendency was a study by Oh and Ditton (2006) who used a self-evaluated level of constraint on developing further skills and knowledge as an index item: While the item was used in the specialisation index, it demonstrated poor consistency with other index items. Less subjective approaches to measuring this dimension have been used in non-angling recreational studies. For example, the ability to identify bird species was positively related to other specialisation indicators (McFarlane, 1994; Kim *et al.* 1997). To apply this approach to angling studies, participants could be asked to distinguish between morphologically similar tuna species and/or asked a series of questions pertaining to life history, management or stock status of game species.

CHAPTER FIVE

Using a specialisation 'filter' to compare attitudes, behaviours and socioeconomic characteristics between private boat and charter boat fishers

5.1 Introduction

Early studies of angling populations established that there is no such thing as an 'average angler' and that angling populations consist of heterogeneous sub-groups with diverse motivations and expectations (e.g. Schafer, 1969; Hendee, 1974; Knopf *et al.* 1974; Bryan, 1976). Consequently, the assessment of a fishery as an aggregate profile of its constituents is likely to be misleading, obscure diversity and ignore particular resource requirements of different sub-groups. In recognition of fishing populations as heterogeneous assemblages, management agencies and researchers are increasingly realising the value of identifying diversity. Most studies that explore sub-groups within fishing populations reveal heterogeneous groups of individuals with differing values, behaviours and attitudes. Furthermore, many of those studies also acknowledge that such differences need to be recognised in management frameworks that maximise acceptance of and compliance with regulations. Graefe (1981) asserts that "the upshot of this type of research is that understanding what is important to identifiable segments of the fishing population will lead to the ability to predict how these segments will be differentially impacted by various allocation schemes and fishing regulations". Hutt and Bettoli, (2007) suggest that ignoring the diversity within an angling population can lead to unforeseen conflicts over management decisions. Schramm *et al.* (1991) and Wilde *et al.* (1998) further propose that a better understanding of angler sub-groups targeting the same resource is required to resolve conflicts between affected groups.

Initial studies exploring diversity among angling sub-groups focused on developing typologies based on anglers' attitudinal and motivational characteristics (e.g. Driver and Cooksley, 1977; Phillips and Ferguson, 1977;

Manfredo *et al.* 1978). These studies were precipitated by the 'multiple satisfactions approach' to fish and game management proposed by Hendee (1974), which recognised that hunters and fishers gained satisfaction from experiential aspects of their sport other than traditionally recognised measures of success such as catching and/or killing prey. The multiple satisfactions approach was also seminal to the development of Bryan's (1977: 175) recreational specialisation concept, wherein he defined recreational specialisation as "a continuum of behaviour from the general to the particular, reflected by equipment and skills used and activity setting preferences". The framework underpinning recreational specialisation has since been re-conceptualised and reapplied in numerous studies, and was used to examine Tasmanian game fishers in the previous chapter.

Another way of identifying meaningful social sub-groups of fishers is by criteria useful for management. Examples include the type of water fished, fishing mode employed, species targeted, tournament participation and/or affiliation with angling clubs or associations. Studies that have compared managerially relevant sub-populations of fishers vary markedly in scope and scale; that is, some have used a narrow species/location focus whilst others have compared angler sub-populations across species and location boundaries. For example, Gigliotti and Petyton (1993) compared values, behaviours and management attitudes between members and non-members of a trout fishing organisation who fished a specific stretch of a river. In contrast, Loomis and Ditton (1987) compared motivations and participation between and among participants in an international fishing tournament with a random sample of saltwater fishers from the state-wide angling database. Nonetheless, published studies generally report considerable differences between and among fisher sub-populations, demonstrating the value of employing population segmentation approaches and reinforcing the growing consensus that angling populations are not homogeneous.

In this chapter, Tasmanian private boat and charter boat game fishers were compared with respect to demographic characteristics, fishing activity, commitment, participation, fishing behaviour, species preferences,

conservation orientation, motivations, consumptive orientation and attitudes to management. From a management perspective, the two angling populations, whilst targeting the same species and fishing the same locations, are clearly defined as 'sectors' within the recreational game fishing population. Therefore, results from this study may have implications for a targeted management approach if different resource requirements are identified for the two groups.

Despite the existence of both private boat and charter 'sectors' in many fisheries, particularly game fisheries, to date no peer-reviewed studies have compared socio-economic variables between the two groups within a fishery. However, two reports have detailed differences between private boat fishers and charter boats fishers, and will be used to contextualise the results of this study.

First, Ditton *et al.* (1998) compared demographic characteristics, participation frequency, species preference and management options between private boat and charter boat fishers and between local and non-local fishers in a social and economic study on a recreational Atlantic bluefin tuna fishery in the United States. While comparisons between angler groups were not the primary objective of the study, greater differences were detected according to fishing sector than by place of residence, supporting the approach used in the current study.

Second, Salz *et al.* (2001b) compared socioeconomic attributes including socio-demographic information, motivations and consumptive orientation between private boat fishers, 'party' boat fishers and shore fishers in Massachusetts, also in the United States. However, the value of this study for comparative purposes is limited by the differences between 'party' boats and charter boats, as used in the current study. Party boat fishers are charged on a per customer basis for regularly scheduled trips rather than operating on a fixed fee per trip basis. Compared to charter boats, party boats are generally larger and accommodate more fishers who usually have less input into decisions about where to fish and what species to target.

Based on these two studies, and on other studies that have demonstrated significant differences between angler sub-populations within recreational fisheries (e.g. Loomis and Ditton 1987; Gigliotti and Petyton 1993; Wilde *et al.* 1998; Wright and Sanyal 1998), it is assumed that grouping anglers according to whether they fish from private boats or charter boats will provide insight into a level of diversity that would not be apparent if anglers were assessed at an aggregate level. In other words, it is expected that the results will demonstrate that the existence of two specific angling groups is not merely evidence of an arbitrary division of anglers based on private access to a suitable boat. This prediction is further supported by the observation of significant differences between private and charter boat fishers in the proportion of respondents within specialisation defined groups in Chapter 4.

5.1.1 Study Objectives

Using the results from Chapter 4 as a guide, specific hypotheses were developed for variables that were also shown to be affected by specialisation. For variables unaffected by specialisation in Chapter 4, no hypotheses were developed due to a paucity of relevant research from which to formulate hypotheses. Accordingly, from the combined results of the current and previous chapter, significant results between sectors will be assessed as to whether differences observed were specialisation-mediated or specialisation independent. In doing so, the effectiveness of the specialisation construct in identifying sector based differences will be evaluated. In addition, the results will be used to assess the implications for the management of the Tasmanian game fishery, with implications for comparable fisheries that contain well defined 'sectors' targeting the same species. Furthermore, the results will also be used to inform further contextual development of specialisation theory based on sector identification of fishers.

5.2 Methods

5.2.1 Sample

Separate surveys were used to collect data from the two angling groups. For charter boat fishers, all data were collected using a mail questionnaire distributed to fishers by charter boat operators during the 2007 game fishing season. For private boat fishers, the majority of data elements were collected by a mail survey sent at the end of the 2006 game fishing season. Avidity and trip length data were collected through a telephone/diary survey of private boat fishers in 2007. For most questions, the wording and formatting were identical across the two questionnaires to facilitate direct comparisons between groups. For detailed information on how the surveys were conducted, see Chapter 3.

5.2.2 Variables

Avidity and participation

Avidity was measured as the number of days spent game fishing over a 12 month period, irrespective of whether other types of fishing were also undertaken on days spent game fishing. For private boat fishers, data from both the mail questionnaire and the telephone/diary survey were used.

Data were also collected to determine the duration (in days) of trips taken away from home that involved game fishing and the number of days spent game fishing on individual trips. The length of a trip was defined as "the number of days spent away from your usual place of residence in which game fishing was undertaken". Therefore, game fishing participation may have been incidental or not a primary motivation for a trip.

The number of species caught was used as a measure of game fishing experience (see Chapter 3 for justification). Of eight game species identified in the survey, respondents were asked to disclose which of the species they had *ever* caught (in Tasmania).

Demographic characteristics

Six demographic measures were compared between the two sectors: age, gender, personal income, employment status, highest level of education attained and fishing club membership.

To compare mean ages, continuous data were used. However, to compare age distributions, categorical data were used by grouping ages into ten year age categories.

Annual personal income ($AUS before tax) details of respondents were collected as categorical data. With the exception of the lowermost (< $20,000) and uppermost (> $100,000) income categories, data were grouped into $10,000 income categories. Accordingly, a total of ten response categories were offered.

Respondents were asked to nominate which of the following categories to best described their current employment status: "full-time employed", "part-time employed", "casually employed", "self-employed", "student", "unemployed", "retired", and "non-retirement pensioner". Respondents were also asked to nominate one of the following categories to best describe their highest level of education attained: "junior schooling (≤ 15 years of age)", "junior high schooling (> 15 years of age)", "HSC/matriculation", "trade qualification", 'diploma", and "university degree". The relative frequencies of responses to each category were compared between sectors.

Two measures were used to compare the level of fishing club membership between the two sectors. The first compared membership of game fishing clubs or associations, while the second compared membership with any fishing club or association.

General fishing profiles

Participation in and commitment to 'other' fishing activities (that is, to non-game fishing activities) were compared between sectors. Participation profiles were created by collecting annual avidity data relating to fishing in saltwater

from private boats, fishing in saltwater from the shore, pier, or other structure, and fishing in freshwater. General fishing commitment was measured by asking respondents to ascribe the importance of fishing compared to other outdoor activities they participate in. Three response categories were offered: "my most important outdoor activity", "my second most important outdoor activity", and "only one of many outdoor activities that I do".

Commitment to game fishing

This variable was measured by asking respondents to indicate the level of importance they ascribed to game fishing compared to other types of fishing they participate in, based on the following four categories: "my only type of fishing", "my most important type of fishing", "my second most important type of fishing", and "only one of many types of fishing that I do".

Game fishing abilities

Respondents were asked to assess their game fishing abilities by comparing them to "other game fishers". Three response categories were offered: "less skilled", "equally skilled", and "more skilled".

Social group affiliation[28]

The frequency by which respondents from both sectors fished with the following groups whilst game fishing were compared: "alone", "with friends", "with family", "with family and friends together", and "with members of a fishing club". Respondents were offered the choice of four response categories: "never", "sometimes", "often" and "always". These were sequentially coded between 1 and 4 to represent participation frequency as nominal scale data i.e. "never" was represented as 1 while "always" was represented as 4.

History of species capture

[28] Respondents were removed from analysis if they had only participated in one game fishing trip during their life at the time of being surveyed. These anglers were not considered to be in a position to provide information relating to this variable after only one trip. This resulted in the exclusion of eight and 27 private boat and charter boat fishers, respectively.

Respondents were asked to disclose which of the eight species used in the survey they had *ever* caught in Tasmanian waters. The proportion of anglers who reported catching each of the eight species was compared between sectors.

Species preference

To determine whether the members of different angling groups preferred to catch different species, anglers were asked to nominate their preferred game fish species among those they had reported catching during their lifetime[29]. Three species – striped tuna, yellowtail kingfish and blue shark – were excluded from analysis due to low numbers[30]. Therefore, of the eight species used for survey purposes, five were retained for analysis – albacore tuna, SBT, yellowfin tuna, mako shark and striped marlin.

Fish type targeted[28]

Respondents were asked to estimate the relative percentage of effort they generally apportion to fishing for tunas, sharks, marlin and "other"[31] fish when game fishing. The percentage of effort attributed to fish types and the proportion of fishers that targeted fish types were compared between sectors.

Motivations

Motivations for fishing were measured using 18 scale items developed and refined by Driver (1977) and Driver and Cooksey (1977) to understand the benefits anglers expect to receive from recreational fishing. Two additional items – "due to reports of good fish availability" and "due to good weather conditions" were also used. Respondents were asked to evaluate the importance of each item on a five point scale from "not at all important" (1) to

[29] It was reasoned that fishers were not in a position to prefer a species if they had not caught that species. It was also reasoned that if species not caught were able to be nominated, a large percentage of fishers from both sectors would nominate striped marlin, a species rarely caught in Tasmanian waters.

[30] The inclusion of these species would violate the chi-squared assumption of minimum expected cell frequency

[31] In order of prominence, the six most common "other" species were striped trumpeter (*Latris lineata*), blue eye trevalla (*Hyperoglyphe antarctica*), flathead (*Platycephalus bassensis* and *P. richardsoni*), morwong (*Nemadactylus macropterus*), squid (*Nototodorus gouldi* and *Sepioteuthis australis*) and yellowtail kingfish (*Seriola lalandi*)

"extremely important" (5)[32]. Related items were grouped into five catch related categories (*Excitement and Adventure*, *Escape, Relaxation, Natural Environment*, and *Social*) and two non-catch related categories (*Fishery Resource* and *Skills and Equipment*). An additional category titled *Miscellaneous* contained three unrelated items.

Reliability analyses conducted on data pooled between sectors determined that the internal consistency of all categories of related items were insufficiently reliable to be used as indices[33]. Consequently, further analysis used individual items only.

Consumptive orientation

Consistent with previous studies (Graefe, 1980; Ditton and Fedler, 1984; Fedler and Ditton, 1986; Fisher, 1997; Sutton and Ditton, 2001; Anderson *et al.* 2007), consumptive orientation was represented by four domains: *Catching Fish*; *Catching Numbers of Fish*; *Catching Large/Trophy Fish* and *Retaining Fish*. Thirteen items from previous studies were used, in addition to one other item that did not correspond to any of the four domains, namely 'it doesn't matter to me what type of fish I catch". This item was included to explore angler's attachment to particular fish species. For each item (i.e. statement), respondents were asked to rate their level of agreement on a five point scale from "strongly disagree" (1) to "strongly agree" (5)[34].

Items in each of the four domains were summed to calculate an index for each domain, and then compared between sectors. Reliability analyses conducted on data pooled between angling groups determined that for two domains, *Catching Large/Trophy Fish* and *Retaining Fish*[35], Cronbach's coefficient values were slightly less than the threshold value of 0.70 recommended by

[32] A sixth response category, "unsure" was also used. However, due to the low number of responses, data were excluded from analysis.
[33] The range of Cronbach's alpha coefficients was between 0.34 and 0.68 (see Table 10). Pallant (2007) cautions the use of indices with coefficients below 0.7. These low values precluded the use of exogenous mean values (i.e. indices) for all categories.
[34] A sixth response category, "unsure" was also used. However, due to the low number of responses, data were excluded from analysis.
[35] The item "I usually eat the fish I catch" was omitted from the domain to improve index reliability.

Pallant (2007). Therefore, results generated for these two domains will need to be interpreted cautiously. In a second tier of analysis, comparisons between angling groups were also conducted for each of the 14 *items* within the four domains.

Conservation orientation

Responses to the open-ended question "*What do you think is the most important issue facing the recreational game fishery in Tasmania*" were collapsed into a binomial variable depicting individuals' conservation orientation. The binomial approach assigned anglers to one of two categories: a "conservation oriented" category and a "non-conservation oriented" category. To qualify as conservation oriented, respondents needed to acknowledge the need to sustain fish stocks and/or preserve the aquatic environment in their response.

A closer inspection of conservation oriented responses revealed a considerable number that attributed all perceived threats to game fish viability to sources other than recreational fishing – for example, commercial fishing, or pollution. Accordingly, a second binomial variable was developed to distinguish between responses offering a degree of ownership of the plight of game fish stocks by recreational fishers and those that did not.

Management preferences

Respondents were asked for their level of agreement with seven proposed management scenarios and two general initiatives relating to game fishing in Tasmania. All proposed management scenarios were more restrictive than those prevailing at the time of the survey. Agreement levels were indicated on a five point scale from "strongly disagree" (1) to "strongly agree" (5)[7].

5.2.3 Analysis

Unless stated otherwise, comparisons between private boat fishers and charter boat fishers were conducted using student t-tests for continuous data and Chi-

square tests for categorical data. Significance for all tests was determined *a priori* at $p < 0.05$.

5.2.4 Hypotheses

Many of the variables used in this chapter were also used in Chapter 4 to identify differences between and among angler groups defined by recreational specialisation. Due to the highly significant result (i.e. $p < 0.005$) suggesting that private boat fishers were, on average, more specialised, specific hypotheses were developed for nine variables shown to be affected by specialisation. To qualify, significant differences were required between all three specialisation-based groups; that is, differences between only two of the three groups were not used to develop hypotheses as the effects of specialisation were not apparent across the whole spectrum of anglers, regardless of whether the difference between two groups was consistent with specialisation theory. Accordingly, of the six and seven significant differences observed for motivational items and consumptive orientation items in Chapter 3, none was used.

Table 5.1. Hypotheses predicting the direction of influence of nine variables based on the results observed in Chapter Four

	Predicted Direction of Influence	
Variable	Charter Boat Fishers	Private Boat Fishers
Avidity	-	+
Experience (number of species caught)	-	+
Income	-	+
Game Fishing Club Membership	-	+
Game Fishing Abilities	-	+
Social Group Affiliation (with game fishing club members)	-	+
Species Preference (albacore tuna)	+	-
Species Preference (bluefin tuna)	-	+
Conservation Orientation	-	+

5.3 Results

5.3.1 Avidity and participation

Avidity[36]

As predicted, the mean number of days fished for charter boat fishers (M = 3.61, SD = 3.22) was significantly less than for private boat fishers[37] (M = 9.19, SD = 9.90): t (438) = 6.441, p = 0.000.

Trip length

No significant differences in mean trip length (in days) were observed between private boat fishers (M = 2.50, SD = 4.49) and charter boat fishers, M = 2.49, SD = 4.41; t (623) = -0.006, p = 0.995. However, whilst on game fishing trips, private boat fishers (M = 1.59, SD = 0.97) fished on significantly more days than charter boat fishers (M = 1.10, SD = 0.40): t (623) = -6.593, p = 0.000. The combined results demonstrate that while mean trip length was almost identical, private boat fishers spent, on average, a greater percentage of their trip time engaged in game fishing. In fact, private boat fishers and charter boat fishers spent 63.7% and 43.9% of day's game fishing relative to the overall time spent on trips, respectively.

The relative proportions of both 1-day trips (private boat, 46.1%; charter boat, 66.5%) and multi-days trips (private boat, 53.9%; charter boat, 33.5%) were compared. Charter boat respondents indicated going on a significantly higher proportion of 1-day trips than private boat fishers, X^2 (1, n = 625) = 20.22, p =

[36] It is important to note that that for both sectors, the mean avidity values refer to game fishing trips pertaining to each angling mode only i.e. it does not include private boat fishing trips undertaken by charter boat fishers or vice versa. Data collected through the private boat fisher's questionnaire revealed that charter boat trips constituted only 1.2% of the total number of days fished by respondents. While corresponding data were not collected from charter boat fishers, values are assumed to be also low. Furthermore, the private boat questionnaire and telephone/diary survey determined that, for private boat fishers, the percentage of days fished from boats owned by other people was 8.8% and 10.1%, respectively.

[37] Avidity data for private boat fishers were also collected through the telephone/diary survey. However, differences between the both values used were not significant at p = 0.05.

0.000, phi = 0.183.[38] In regard to multi-day trips, average trip length was 3.8 and 5.8 days for charter boat and private boat fishers respectively.

Experience

There was a significant difference in the mean number of game fish species caught by private boat fishers ($M = 3.60$, $SD = 1.67$) and charter boat fishers ($M = 2.59$, $SD = 1.80$) during their lifetime: $t\ (438) = 6.019$, $p = 0.000$.

5.3.2 Demographic characteristics

Age

The mean age of responding private boat fishers ($M = 47.10$, $SD = 9.70$) was significantly higher than the mean age of charter boat fishers, $M = 42.36$, $SD = 12.61$: $t\ (433) = 4.21$, $p = 0.000$. The overall trend of age distribution of grouped data showed that charter boat fishers dominated the younger age groups (less than 40 y/o) and private boat fishers dominated the older age groups (40 – 69 y/o). Significant differences were observed for the relative percentages of anglers in two age groups: less than 20, and 20 to 29 (Figure 5.1). Of the former, charter boat fishers had a significantly higher percentage of respondents (2.9%) with ages in this range than private boat fishers (0%): $X^2\ (1, n = 441) = 5.41$, $p = 0.005$, phi = 0.133[39]. For the 20 to 29 age group, charter fishers also had a significantly higher percentage of respondents (14.4%) than private boat fishers (1.9%): $X^2\ (1, n = 441) = 24.01$, $p = 0.000$, phi = 0.243[39].

[38] Chi-square test output was subject to Yates Continuity Correction to prevent overestimating values when using a 2x2 table (Pallant, 2007).

[39] Chi-square tests are sensitive to low count numbers in cells and at least 80% of cells should have frequencies of five or more (Pallant, 2007). In this case, two cells (50% of all cells) had expected counts less than five. Therefore, this result needs to be interpreted cautiously as the assumption of minimum expected cell frequency was violated.

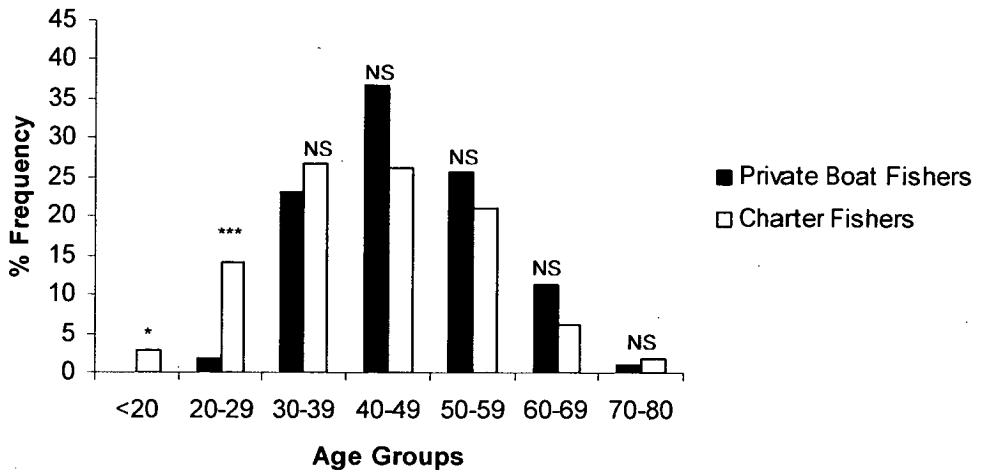


Figure 5.1. Frequency histogram of age distributions for private boat and charter boat fishers. Chi square tests were conducted for each age group. Asterisks denote significant differences at * $p < 0.05$ and *** $p < 0.001$. NS denotes non-significance at $p < 0.05$.

Gender

Charter boat respondents comprised a significantly higher percentage of females (9.4%) than private boat respondents (0.4%): X^2 (1, n = 435) = 19.95, p = 0.000, phi = -0.226.[11]

Income

To compare income values, the non-parametric Mann-Whitney U-test was used in preference to a t-test due to the non-normal distribution of the data resulting from the large number of respondents in both the lowermost (<$20K p/a) and uppermost (>$100K p/a) income categories (Figure 5.2). The test revealed a significant difference in median income levels between private boat fishers (*Md* = $60-$70K, n = 246) and charter boat fishers (*Md* = $50-$60K, n = 167): U = 16452, z = -3.46, p = 0.001.

A relatively high proportion of charter boat fishers were in lower income categories (up to 50K p/a) whereas a greater proportion of private boat fishers were in higher income categories (>70K p/a). Significant differences were observed for two income categories: less than $20K, and $90-$100K. For the former, charter boat fishers had a significantly higher percentage of respondents (12.0%) with personal incomes in this range than private boat fishers (4.5%): X^2 (1, n = 413) = 7.02, p = 0.008, phi = 0.140. For the $90-

$100K income group, a significantly higher proportion of private boat fishers (4.9%) were represented than was observed for charter boat fishers (0.6%): X^2 $(1, n = 413) = 4.65, p = 0.031$, phi = -0.120.[38]

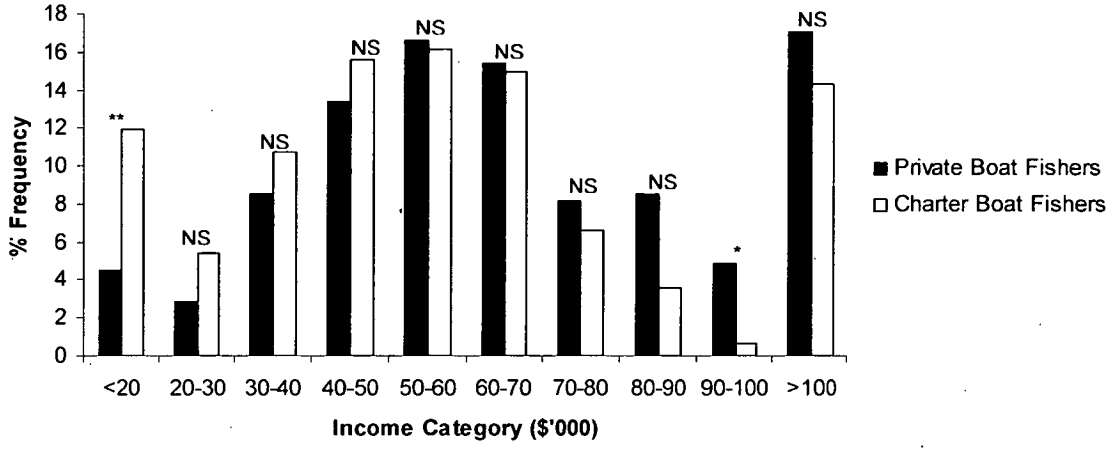


Figure 5.2. Frequency histogram of income distributions of private boat and charter boat fishers. Chi square tests were conducted for each age group to determine differences. Asterisks denote significant differences at * $p < 0.05$ and ** $p < 0.01$. NS denotes non-significance at $p < 0.05$.

Employment

Significant differences in the relative frequencies of employment status were observed for two categories: self-employed and unemployed (Table 5.2). Private boat fishers had a significantly higher proportion of self-employed respondents than charter boat fisher while a significantly higher proportion of charter boat fishers were unemployed than among private boat fishers.

Table 5.2. Chi-Square tests for independence between employment categories for private boat and charter boat game fishers

	Private Boat Fishers (n=253) %	Charter Boat Fishers (n=171) %	X^2	phi	sig.
Full Time Employed	48.2	57.9	3.45	-0.095	0.063
Self employed	39.9	17.5	22.89	0.238	0.000
Part time employed	1.2	4.7	3.64	0.026	0.056
Casually employed	2.8	7.0	3.37	-0.101	0.066
Non-retirement pensioner	2.0	1.2	0.063	0.031	0.802
Retired	5.5	8.2	0.774	-0.052	0.379
Unemployed[a]	0.4	3.5	4.325	-0.120	0.038

[a] 1 cell (25%) had expected counts less than 5. Therefore, the minimum expected cell frequency assumption was violated

Education

Significant differences were observed for two categories: university degree and trade qualification (Table 5.3). A greater proportion of respondents with university degrees were observed among charter boat fishers while a higher proportion of private boat game fishers nominated a trade qualification as their highest level of education.

Table 5.3. Chi-Square tests for independence between educational categories for private boat and charter boat game fishers

	Private Boat Fishers (n=257) %	Charter Boat Fishers (n=171) %	X^2	phi	sig.
University Degree	12.5	25.7	11.51	-0.170	0.001
Diploma	13.2	9.90	0.768	0.050	0.381
HSC/Matriculation	14.0	18.1	1.027	-0.056	0.250
Junior (<15 years)	4.70	3.50	0.116	0.028	0.734
Junior High (>15 years)	11.7	17.0	1.990	-0.075	0.158
Trade Qualification	44.0	25.7	13.930	0.185	0.000

Fishing club membership

Almost a quarter of private boat anglers (24.5%) were affiliated with game fishing clubs, compared to only 7.0% of charter boat fishers: X^2 (1, n = 432) = 20.46, p = 0.000, phi = -0.225. For 'general' fishing club and association membership, no significant difference was observed between private boat fishers (3.4%) and charter boat fishers (7.0%), X^2 (1, n = 432) = 2.126, p = 0.145, phi = 0.092.[38]

5.3.3 General fishing profiles

Activity profiles

Overall, there was no significant difference in the total number of days fished for non-game species between the angling groups. However, significant differences were observed between groups for all three non-game angling modes (Table 5.4). Private boat game fishers reported spending nearly twice as many days angling for non-game saltwater species from private boats than did charter boat fishers, who, in turn reported fishing nearly four times as

many days in saltwater from the shore or structures, and almost twice as many days fishing in freshwater.

Table 5.4. Independent samples t-tests to compare non-game fishing activity between private boat and charter boat game fishers

	Private Boat Fishers (n = 263)		Charter Boat Fishers (n = 169)			
	%[a]	M (+/-SD)	%[a]	M (+/-SD)	t	p (2-tailed)
Saltwater (from private boat)	99.6	34.8 (32.9)	84.6	18.9 (24.7)	5.380	0.000
Saltwater (from shore or structure)[b]	31.6	2.2 (5.6)	69.2	8.5 (16.1)	-4.912	0.000
Freshwater[b]	27.4	3.2 (8.2)	43.2	8.3 (21.7)	-2.897	0.004
Total	99.6	40.3 (35.3)	95.3	35.7 (44.5)	1.124	0.262

[a] denotes the percentage of respondents who reported spending one or more days fishing

[b] Both t and p values are based on output for "unequal variances not assumed" due to violation of Levene's assumption of homogeneity of variance

To compare aggregated levels of activity for *all* fishing undertaken over a 12 month period, participation data for game fishing (reported earlier) needs to be added to total days fished in Table 5. In this case, private boat fishers (M = 49.49, SD = 35.30) were significantly more avid than charter boat fishers (M = 39.31, SD = 44.52): t (430) = 2.627, p = 0.028.

Commitment to general fishing

Significant differences between the two angling groups were observed in the level of importance ascribed to general fishing activities: X^2 (2, n = 393) = 46.42, $p < 0.001$ (Table 5.5). Private boat fishers were more likely to nominate fishing as their most important activity whilst the majority of charter boat fishers specified that fishing was only one of many outdoor activities that they participated in.

Table 5.5. The relative importance of fishing as an outdoor activity between private boat and charter boat game fishers

	Private boat fishers (n = 253)	Charter boat fishers (n = 171)
	%	%
My most important outdoor activity	66.7	41.5
My second most important outdoor activity	13.8	6.1
Only one of many outdoor activities that I do	19.5	52.4

5.3.4 Commitment to game fishing

The importance ascribed to game fishing was very similar between the two angling groups: X^2 (3, n = 393) = 0.929, p = 0.818 (see Table 5.6). About three quarters of fishers from both sectors expressed that game fishing was only one of many types of fishing that they participated in. Only a very small number of fishers from both sectors indicated that game fishing was their exclusive fishing activity.

Table 5.6. The relative importance of game fishing to other fishing types between private boat and charter boat game fishers

	Private boat fishers (n = 246) %	Charter boat fishers (n = 147) %
My only type of fishing	2.4	1.4
My most important type of fishing	19.5	18.4
My second most important type of fishing	13.0	11.6
Only one of many types of fishing that I do	65.0	68.7

5.3.4 Game fishing abilities

Significant differences were observed in fishing abilities between the two angling groups: X^2 (2, n = 406) = 6.58, p < 0.037 (Table 5.7). Charter boat fishers were more likely to consider themselves to be "less skilled" than other fishers while a greater percentage of private boat fishers considered themselves as "more skilled" than other fishers.

Table 5.7. Chi square test to compare self-assessed skill levels between private boat and charter boat game fishers

	Private boat fishers (n = 259) %	Charter boat fishers (n = 147) %
Less Skilled	32.8	44.9
Equally Skilled	57.9	49.7
More Skilled	9.3	5.4

5.3.5 Social group affiliation

Private boat anglers indicated that they fished with three social groups significantly more often than charter boat fishers – "family", "family and

friends together" and "fishing club members" (Table 5.8). However, for both sectors, friends were the most frequent fishing companions.

Table 5.8. Independent samples t-tests to compare fishing frequency with various social groups between private boat and charter boat game fishers

	Private boat fishers (n = 252)	Charter boat fishers (n = 149)	t	p (2-tailed)
By yourself	1.23 (0.47)	1.34 (0.64)	-1.832	0.095
With friends	2.97 (0.99)	2.91 (1.11)	0.600	0.561
With family	2.52 (1.05)	2.22 (1.04)	2.724	0.007
With friends and family together	2.63 (1.06)	2.21 (1.06)	3.741	0.000
With fishing club members	1.42 (0.67)	1.27 (0.64)	2.170	0.028

Standard deviation scores are in parentheses

Mean scores for all items were based on responses to the following categories; 1 = Never, 2 = Sometimes, 3 = Often, 4 = Always

5.3.6 History of species capture

For seven of the eight species used in the survey, the proportion of private boat anglers who had caught them was significantly greater than the corresponding proportion of charter boat fishers (Figure 5.3). The most significant differences ($p < 0.001$) were for albacore tuna (PB, 92.4%: CB, 72.7%), yellowfin tuna (PB, 57.2%: CB, 34.1%) and blue shark (PB, 23.1%: CB, 9.1%). For striped marlin, there was still a considerable difference between the sectors (PB, 4.9%; CB, 2.3%), despite being non-significant, reflecting the low numbers caught by either sector.

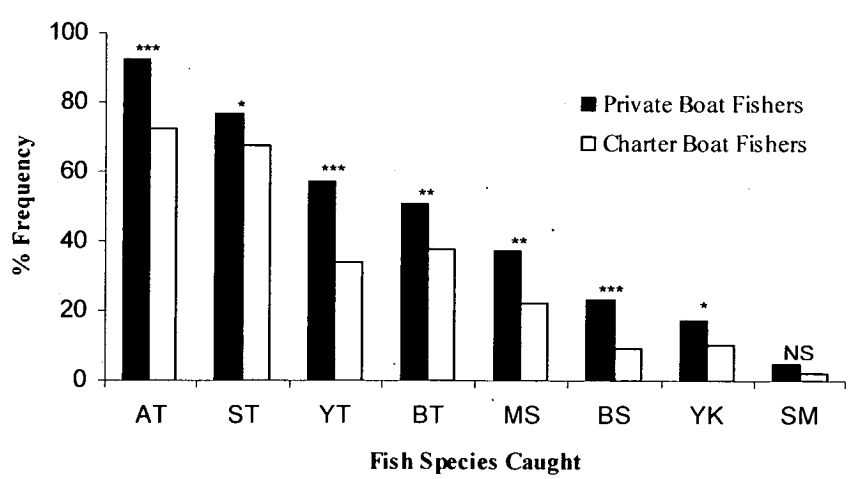


Figure 5.3. Frequency histogram of the proportions of both private boat (n = 264) and charter boat gamefishers (n = 171) who indicated catching the following Tasmanian game fish species during their lifetime: albacore tuna (AT), striped tuna (ST), yellowfin tuna (YT),

bluefin tuna (BT), mako shark (MS), blue shark (BS), yellowtail kingfish (YK), and striped marlin (SM). Chi Square Tests were conducted for each species to determine differences between angler groups. Asterisks denote significant differences at * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$. NS denotes non-significance at $p < 0.05$.

5.3.7 Species preference

No significant differences in species preferences between angling groups were apparent for any of the five species examined (Figure 5.4). Chi-Square and p values for each species were as follows: albacore tuna ($X^2 = 1.809, p = 0.179$), bluefin tuna ($X^2 = 1.114, p = 0.291$), yellowfin tuna ($X^2 = 2.927, p = 0.087$), mako shark ($X^2 = 0.815, p = 0.367$), striped marlin ($X^2 = 0.407, p = 0.523$).

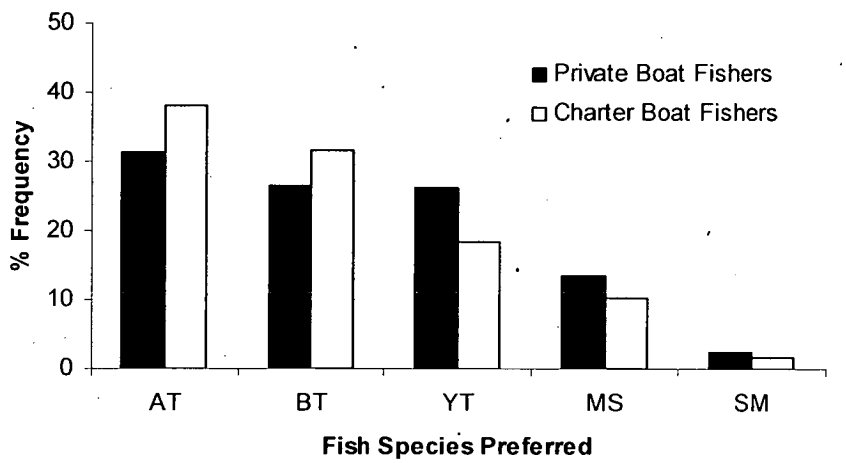


Figure 5.4. A comparison of most preferred species between private boat fishers ($n = 245$) and charter boat fishers ($n = 146$) for the following Tasmanian game fish species: albacore tuna (AT), bluefin tuna (BT), yellowfin tuna (YT), mako shark (MS), and striped marlin (SM).

5.3.8 Fish type targeted

Charter boat fishers noted that, on average, they expend a significantly greater overall proportion of their effort targeting tuna species compared to private boat fishers (Table 5.9). On the other hand, private boat fishers expressed that they spend a greater overall proportion of their effort targeting pelagic sharks and marlin than charter boat fishers. However, the difference in effort was significant only for striped marlin.

Table 5.9. Results of independent samples t-tests to compare effort targeting four fish types between private boat and charter boat game fishers

	Private boat fishers (n = 263) Mean (+/- *SD*)	Charter boat fishers (n = 148) Mean (+/- *SD*)	t	p (2-tailed)
Tuna (all species)[a]	71.31 (31.56)	80.61 (23.51)	-3.396	0.001
Pelagic sharks (i.e. mako, blue)[a]	13.56 (21.25)	10.25 (16.80)	1.706	0.089
Marlin[a]	6.57 (13.71)	3.91 (9.03)	2.336	0.020
Other	4.51 (14.10)	5.36 (16.33)	-0.542	0.588

[a] Both t and p values are based on output for "unequal variances not assumed" due to violation of Levene's assumption of homogeneity of variance

Of the four types of fish shown in Table 5.10, a significant difference between the sectors was only apparent for tuna (all species). All charter boat respondents indicated that they targeted tuna; however, nearly 5 % of private boat respondents (12 fishers) indicated that they did not target tuna when game fishing. All 12 respondents indicated that they fished for sharks either exclusively or in combination with "other" species.

Table 5.10. Chi-square tests for independence to compare the proportions of private boat and charter boat game fishers targeting fish types

	Private Boat Fishers (n = 263) %	Charter Boat Fishers (n = 148) %	X^2	phi	p (2-sided)
Tuna (all species)	95.4	100	5.014	0.127	0.025
Pelagic sharks	48.7	49.3	0.000	0.006	0.908
Marlin	31.2	29.7	0.036	-0.015	0.850
Other	19.0	21.7	0.268	0.032	0.516

X^2 and p values were applied using Yates continuity correction for each species

5.3.8 Motivations

The majority of motivational items were endorsed as being of at least moderate importance by fishers from both groups, as demonstrated by mean item scores higher than the median value (3) for 15 of the 20 items (see Appendix 5). Non-catch related items were ranked more highly as motivators; they represented the top five and six items for private boat and charter boat fishers, respectively. For both sectors, the items "for relaxation", "to be outdoors", "to be with friends" and "to be close to the water" were ranked within the top five. The most important catch related item for both sectors was "for the experience of catching fish". Despite common perceptions of game

fishing being defined by catching large fish, the item "to catch a trophy fish" rated as the fourth most important catch-related item for both groups.

Significant differences between angling groups were evident for four of the ten non-catch related motivational items (Table 5.11). Charter boat fishers ranked the items "to experience adventure and excitement" and "to experience unpolluted natural surroundings" significantly higher than private boat fishers. The item "for relaxation" was the highest ranked motivational factor for both groups, but was deemed to be of greater mean importance for private boat fishers. The most significant difference between the groups among the non-catch related items was for the item "for family recreation" with private boat fishers rating the importance of this item more highly. For catch-related motivations, only one significant difference was detected between angling groups; private boat fishers rated "to obtain fish to eat" more highly. In the miscellaneous items category, private boat fishers indicated that weather conditions were more important as a motivating factor.

Table 5.11. T-tests for mean differences in importance of motivational items between private boat and charter boat game fishers

	Private boat fishers (n = 259) Mean (+/- *SD*)	Charter boat fishers (n = 149) Mean (+/- *SD*)	t	p (2-tailed)
Excitement and Adventure (α = 0.507)				
To experience new and different things	3.38 (1.06)	3.57 (1.03)	-1.789	0.074
To experience adventure and excitement	3.43 (1.09)	3.69 (1.04)	-2.005	0.046
Escape and Relaxation (α = 0.478)				
To get away from the regular routine[a]	3.60 (1.20)	3.63 (1.07)	-0.340	0.818
To get away from the demands of other people	3.28 (1.35)	3.42 (1.31)	-0.013	0.308
For relaxation	4.23 (0.82)	4.03 (0.82)	2.378	0.018
Natural Environment (α = 0.657)				
To be outdoors[a]	3.88 (0.97)	3.88 (0.81)	-0.034	0.971
To experience unpolluted natural surroundings[a]	3.67 (1.16)	3.89 (1.02)	-1.979	0.049
To be close to the water	3.79 (1.01)	3.74 (1.06)	1.482	0.139
Social (α = 0.338)				
For family recreation	3.69 (1.03)	3.05 (1.02)	5.630	0.000
To be with friends	3.80 (0.93)	3.75 (0.90)	-0.469	0.656
Mean Item Score for Non-catch Items	**3.68 (1.06)**	**3.67 (1.01)**		
Fishery Resource (α = 0.661)				
To obtain fish to eat	3.56 (1.11)	3.08 (1.15)	4.212	0.000
For the experience of catching fish	3.78 (0.98)	3.64 (1.07)	1.328	0.185
To catch a trophy fish	2.54 (1.30)	2.60 (1.33)	-0.380	0.704
For challenge or sport	3.19 (1.20)	3.36 (1.17)	-1.413	0.156
To fish where it is not difficult to catch fish	2.46 (1.10)	2.35 (1.12)	0.927	0.355
Skills and Equipment (α = 0.635)				
To develop my fishing skills	3.20 (1.08)	3.42 (1.13)	-1.979	0.060
To test my fishing gear	2.52 (1.22)	2.63 (1.24)	-0.565	0.572
Mean Item Score for Catch Related Items	**3.04 (1.14)**	**3.01 (1.17)**		
Miscellaneous Activity Related				
To participate in competition	1.83 (1.09)	1.67 (0.99)	1.468	0.143
Due to reports of good fish availability	2.61 (1.16)	2.50 (1.15)	0.916	0.916
Due to reports of good weather conditions	3.81 (1.11)	3.49 (1.12)	2.803	0.005
Total Mean	**3.32 (1.10)**	**3.27 (1.08)**		

Mean scores for all items were based on responses to the following response categories: 5 = Extremely Important, 4 = Important, 3 = Moderately Important, 2 = Slightly Important, 1 = Not at all Important

Values in parentheses following category titles are Cronbach alpha reliability scores

[a] Both t and p values are based on output for "unequal variances not assumed" due to violation of Levene's assumption of homogeneity of variance

5.3.9 Consumptive orientation

The results in Table 5.12 illustrate significant differences between the two sectors for three of the four consumptive orientation domains. Charter boat fishers were more consumptively oriented to catching numbers of fish and catching large/trophy fish, while private boat fishers expressed attitudes consistent with retaining more fish than charter boat fishers. Despite these differences, the mean order rankings of the domains were the same for each sector. In descending order of importance, they were: (1) catching

large/trophy fish, (2) catching numbers of fish, (3) catching fish (as a measure of success and/or satisfaction), and (4) retaining fish.

Table 5.12. T-tests for mean differences in agreement levels relating to consumptive orientation items between private boat and charter boat game fishers

	Private boat fishers (n = 259) Mean (±*SD*)	Charter boat fishers (n = 146) Mean (±*SD*)	t	p (2-tailed)
Attitudes To Catching Fish (α = 0.77)				
A fishing trip can be successful even if no fish are caught[ab]	2.12 (1.00)	2.30 (1.09)	-1.68	0.093
I'm just as happy if I don't catch a fish[a]	2.89 (1.07)	2.99 (1.10)	-0.888	0.375
If I thought I would not catch a fish I would not go fishing	2.83 (1.26)	2.64 (1.25)	1.455	0.147
I'm not satisfied unless I catch at least something	2.88 (1.07)	2.74 (1.17)	-1.106	0.269
Domain Index Mean	**2.68 (0.84)**	**2.73 (0.90)**	**-0.608**	**0.544**
Attitudes To Catching Numbers of Fish (α = 0.72)				
The more fish I catch the happier I am	2.80 (1.06)	3.16 (1.09)	-3.24	0.001
A successful fishing trip is one where many fish are caught	2.71 (1.02)	2.95 (1.16)	-2.12	0.034
Domain Index Mean	**2.75 (0.90)**	**3.06 (1.01)**	**-3.044**	**0.002**
Attitude to Catching Large/Trophy Fish (α = 0.66)				
I would rather catch 1 or 2 big fish than 10 smaller fish	3.72 (0.98)	3.76 (1.10)	0.507	0.612
The bigger the fish I catch the better the fishing trip	3.10 (1.04)	3.41 (1.04)	-2.805	0.005
I'm happiest when I catch a challenging fish	4.02 (0.83)	4.30 (0.81)	-3.371	0.001
I like to fish where I know I may catch a trophy fish[b]	2.97 (1.09)	3.08 (1.24)	0.888	0.375
Domain Index Mean	**3.46 (0.71)**	**3.62 (0.71)**	**-2.205**	**0.028**
Attitude to Retaining Fish[c] (α = 0.69)				
I'm just as happy if I release the fish I catch[a]	2.70 (1.03)	2.34 (0.87)	3.552	0.000
I want to keep all the fish I catch[b]	2.25 (0.98)	1.92 (0.85)	3.510	0.001
Domain Index Mean	**2.48 (0.88)**	**2.14 (0.74)**	**3.983**	**0.000**
Additional Item				
It doesn't matter to me what type of fish I catch	3.00 (1.04)	3.25 (1.01)	-2.293	0.022
Total Mean	2.92 (1.04)	2.99 (1.06)		

Mean scores are based on levels of agreement to attitudinal statements (items) pertaining to each category. Attitudinal statements were coded as follows: 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree

[a] Items 1,2 and 12 are reverse coded for consistency with other items within the same category

[b] Both t and p values are based on output for "unequal variances not assumed" due to violation of Levene's assumption of homogeneity of variance

[c] item 1, "I usually eat the fish I catch" was omitted to improve reliability of index

Values in parentheses following category titles are Cronbach alpha reliability scores

Consistent with the results observed for consumptive orientation domains, significant differences were observed for individual items within all domains except for *Attitudes to Catching Fish* (Table 5.14). In that domain, charter boat fishers demonstrated a higher level of agreement with both statements; that is, "the more fish I catch the happier I am" and "a successful fishing trip is one in which many fish are caught". Charter boat fishers also demonstrated a higher level of agreement with two of the four statements in the *Attitudes to Catching Large/Trophy Fish* domain - "the bigger the fish I catch the better the fishing trip" and "I'm happiest when I catch a challenging fish". In

addition, charter boat fishers also expressed greater agreement with the 'additional' item, "It doesn't matter to me what type of fish I catch".

Private boat fishers, however, expressed a significantly higher level of agreement with both items in the domain *Attitudes to Retaining Fish*. These were "I'm just as happy if I release the fish I catch[40]" and "I want to keep all the fish I catch". See Appendix 6 for distribution of responses to all items

5.3.10 Conservation orientation

No significant differences were observed between angling groups for either measure of conservation orientation (see Table 5.13).

Table 5.13. Chi-square tests for independence to compare proportions of private boat and charter boat anglers deemed to be 'conservation orientated'

	Private Boat Fishers (n = 259) %	Charter Boat Fishers (n = 147) %	X^2	phi	p (2-sided)
Conservation Orientation #1[a]	56.4	58.5	0.174	-0.021	0.676
Conservation Orientation #2[b]	17.8	21.1	0.676	-0.041	0.411

X^2 and p values were applied using Yates continuity correction for each species

[a] Respondents acknowledged the need to sustain fish stocks and/or preserve the aquatic environment

[b] Respondents acknowledged the impact of recreational fishing on game species viability

5.3.11 Management preferences

With the exception of "a personal bag limit of 5 albacore tuna", all items were supported more strongly by charter boat respondents. However, both sectors expressed a mean level of support higher than the median score for eight of the nine items indicating overall support for most items by both sectors (Table 5.14). The only item with a mean level of support lower than the median score was "southern bluefin tuna to be catch and release only". See Appendix 7 for response distribution.

Significantly greater levels of agreement were expressed by charter boat fishers for four of the seven management proposals - "southern bluefin tuna to be catch and release only", "a personal combined bag limit of one southern

[40] Item was reverse coded for consistency with other items within the domain *Attitudes to Retaining Fish*

bluefin tuna or yellowfin tuna", "game fish possession limits for boats", and "a personal combined bag limit of one mako shark or blue shark". Greater levels of agreement by charter fishers were also indicated for both of the general initiatives; that is, promoting both catch and release and tag and release fishing.

Table 5.14. Independent samples T-tests for mean differences in agreement levels relating to management scenarios between private boat and charter boat game fishers

	Private boat fishers (n = 259) Mean (±*SD*)	Charter boat fishers (n = 146) Mean (±*SD*)	t	p (2-tailed)
SBT to be catch and release only[a]	2.22 (1.01)	2.60 (1.25)	3.358	0.001
Striped marlin to be catch and release only[a]	3.18 (1.24)	3.32 (1.37)	1.027	0.305
A personal combined bag limit of 1 SBT or YT	3.08 (1.26)	3.39 (1.34)	2.352	0.019
A personal combined bag limit of 1 MS or BS	3.49 (1.12)	3.82 (1.23)	2.749	0.006
Gamefish possession limits for boats	3.60 (1.08)	3.94 (1.06)	3.062	0.002
A personal bag limit of 5 albacore tuna[a]	3.62 (1.14)	3.43 (1.27)	-1.468	0.143
A minimum size limit for albacore tuna	3.49 (1.10)	3.71 (1.14)	1.899	0.056
The promotion of catch and release fishing	3.65 (1.05)	3.94 (1.01)	2.637	0.008
The promotion of tag and release fishing	3.54 (1.04)	3.93 (0.99)	3.702	0.000

Mean scores are based on levels of agreement to attitudinal statements (items) pertaining to each category. Attitudinal statements were coded as follows: 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree

[a] Both t and p values are based on output for "unequal variances not assumed" due to violation of Levene's assumption of homogeneity of variance

SBT = southern bluefin tuna, YT = yellowfin tuna, MS = mako shark, BS = blue shark

5.4 Discussion

Significant differences between the two sectors were evident for most classes of variables. These included differences that were hypothesised due to differences in angler specialisation between the sectors, as reported in Chapter 4. Differences that were not hypothesised will be discussed in light of comparable literature.

5.4.1 Avidity and Participation

As predicted, private boat respondents reported higher rates of game fishing activity. They also fished for a greater number of days on trips, and were more likely to undertake multiple-day trips than charter boat respondents. The relative rates of participation between sectors are consistent with game fishing activity reported for Atlantic bluefin tuna fishers (Ditton *et al.* 1998), whereby

private boat and charter boat anglers fished for an average of 9.8 and 4.8 days per year, respectively. Data reported for experience and skill level in the same study suggests that the differences observed were also mediated by specialisation. Comparing angler activity rates in studies on both private boat game fishers (Fisher and Ditton, 1993; Ernst and Young, 2004) and charter boat game fishers (Ditton and Clark, 1994; Ditton and Grimes, 1995; Ditton *et al.* 1996; O'Malley and Glazier, 2001) also suggest greater activity levels among the former. However, to suggest that these differences are a product of angler specialisation is misleading when one considers that many studies on game charter fishers are based on fishers who do not reside close to where they go fishing (i.e. Ditton and Clark, 1994; Ditton and Grimes, 1995; Ditton *et al.* 1996). For those fishers, whose experience, commitment and skills suggest a high level of specialisation, their use of charter boats was contingent on their residential proximity to fishing sites. Therefore, the observation of greater activity as a result of specialisation for private boat fishers compared to charter boat fishers in this study, and by Ditton *et al.* (1998), may only apply for fisheries where the majority of fishers are local residents.

To explain the differing rates of participation, private boat ownership (or access) has clear implications for participation. Most obviously, having access to a boat capable of offshore fishing allows greater flexibility in choosing when and where to fish. In addition, boat (and other game fishing equipment) ownership is a demonstration of behavioural commitment to game fishing which is a key dimension of recreational specialisation (Scott and Shafer, 2001). While some private boat owners may use their boats for other (fishing and non-fishing) activities, it is reasonable to assume that the opportunity to go game fishing was considered when purchasing boats for the majority of private boat owners. Lower rates of avidity for charter fishers may also reflect financial constraints faced by some respondents, a claim supported by lower median incomes observed for this group.

As predicted, private boat fishers were reported to be significantly more experienced than charter boat fishers. These results support the use of the number of game species caught during fisher's game fishing careers as an

effective proxy for experience. In fact, the variable demonstrated the strongest factor loading of the four variables in the specialisation index in Chapter 4. The combined results from the two chapters appear to validate the underlying assumption of a positive relationship between the likelihood of catching a 'new' species and the amount of time fished. The results also suggest minimal recall bias associated with remembering how many game species one has caught.

The results pertaining to species-based effort suggest a slightly greater tendency for private boat fishers to target non-tuna game species. While this may be indicative of lesser specialised charter boat fishers preferring more prolific species, it is also likely to be a reflection of the influence of charter boat operators in deciding which species to target[41]. Perhaps the most pertinent observation is the identification of a small sub-group of approximately 5% of private boat fishers who reported targeting sharks exclusively. Tasmanian shark fishing specialists have been previously described (Anderson, 2006) and focus most of their effort on the north coast, where tuna do not habitually frequent. Their existence is evidence of additional diversity among Tasmanian game fishers which could be recognised when developing future studies. However, it also needs to be recognised that pelagic sharks are also targeted on the east coast by anglers targeting tuna (and marlin).

5.4.2 Demographic characteristics

Whilst not predicted from the results of Chapter 4, the significantly higher mean age of private boat respondents is nonetheless consistent with specialisation theory. As experience is a central component of specialisation (Scott and Shafer, 2001), it follows that older fishers have had greater opportunity to develop experience than younger fishers. This interpretation was not, however supported by Ditton *et al.* (1998) who observed a mean age of 42 for both private boat and charter boat Atlantic bluefin tuna fishers.

[41] Personal communication with charter boat operators suggests that while some clients do choose to target sharks exclusively, it is considered a rare event.

Nonetheless, a review of the literature suggests that the mean age of Tasmanian charter fishers in this study (42.4) was comparable with perhaps the most similar study to the current study in terms of target species: O'Malley and Glazier (2001) reported a mean age of 44.1 for pelagic charter patrons in Hawaii. The most relevant studies in which to compare age results for private boat fishers (Ditton *et al.* 1998; Ernst and Young, 2004) suggest that Tasmanian fishers were, on average, relatively old. Ditton *et al.* (1998) reported the mean age of tuna anglers to be 42, whilst Ernst and Young (2004) reported that for fishers targeting billfish, tunas and sharks off New South Wales, the modal age group was 30-39 (compared to 40-49 in this study).

Whilst this study supported the general observation among game fishing studies of an overwhelming dominance of males, the significantly greater proportion of females observed among charter boat respondents is worthy of note. In light of negligible (i.e. < 5%) female participation reported in the majority of studies of game fishers (i.e. Fisher and Ditton, 1993 Ditton and Clarke, 1994; Ditton and Grimes, 1995; Ditton *et al.* 1996; Ditton *et al* 1998; Ernst and Young, 2004), the 9.4% of female anglers observed in the charter study is relatively high. However, in light of the results produced by O'Malley and Glazier (2001), who observed a high level of female respondents (16%), it is possible that the likelihood of female participation may increase on trips where the opportunity to go fishing is *not* the sole or primary reason for visiting the area in which fishing trips are undertaken. O'Malley and Glazier reported that only 3% of respondents were local residents, and only 18% of non-residents nominated game fishing as a motivating factor to visit Hawaii. While a comparatively low 15.5% of anglers in the current study were non-Tasmanians, results from the Hawaiian study may infer that charter fishing operations in areas that attract 'general' visitors or holiday makers may, as a consequence of location, also attract people not generally associated with game fishing.

As predicted from the results of Chapter 4, private boat fishers had significantly higher mean personal incomes than charter boat fishers. In a recreational specialization context, the purchase of a boat capable of offshore

fishing, plus specialised fishing equipment, is a measure of commitment to the activity, but it also requires the financial capacity to do so. As explained in the previous chapter, boat ownership may present an obstacle for progressing along the specialisation continuum by limiting activity and the development of skills and knowledge. While the use of charter boats by some lower income earners may reflect the comparatively inexpensive nature of Tasmanian charter services, it may also be evidence of a specialisation mediated progression from charter boats to private boats. Despite the difference in mean incomes, they were both comparable with state-wide mean incomes for Tasmanians in 2007 (Australian Bureau of Statistics). This finding may dispel perceptions that game fishing is a pastime for high income earners.

To contextualise the mean incomes of Tasmanian game fishers, comparisons between studies of different game fisheries suggests a large discrepancy in income level between billfishers and other game fishers. Mean incomes of Tasmanian game fishers, especially private boat fishers, are fairly comparable with those reported in other (Australian) non-billfish fisheries. For example, median personal income categories of fishers were AUS$60,000 – $100,000 for NSW fishers targeting striped marlin, tunas and sharks (Ernst and Young, 2004).

5.4.3 General fishing participation and commitment

Respondents from the two angling groups did not differ in their overall fishing activity for non-game species, which was furthermore consistent with the lack of significant differences in membership for non-game fishing clubs. However, there were clear differences between groups in the type of non-game fishing undertaken. As expected, private boat respondents fished on considerably more days in saltwater from private boats; however, this practice was largely offset by higher participation in saltwater fishing from shore or structures, and in freshwater by charter boat fishers. Interestingly, the high percentage of charter boat respondents who reported saltwater non-game fishing from private boats (85%) suggests that many possessed boats or had access to a boat suitable for fishing. Nonetheless, given their use of charter

boats for game fishing, it is likely that many of the boats owned by charter boat fishers were too small or inadequately equipped for game fishing. The significantly higher fishing activity reported from shore or structures by charter boat respondents further suggests that some private boats used by charter boat fishers were also inadequate for some types of non-game fishing.

In terms of aggregated recreational fishing effort (that is, game plus non-game fishing) mean annual participation rates for both sectors were considerably higher than the mean annual number of days fished (6.55) for Tasmanian recreational fishers reported in the *National Recreational Fishing Survey* (Henry and Lyle, 2003). The same survey also reported that only 3% of all respondents fished for more than 25 days per year. Therefore, despite methodological differences between Henry and Lyle (2003) and the current survey, respondents from both sectors in this study may be viewed as highly avid (and by inference, highly specialised) compared with the 'average' angler. Nonetheless, the significantly higher aggregated effort by private boat fishers, coupled with a greater mean expression of commitment to all fishing types, suggests that respondents from this sector were, in terms of all fishing activities, more highly specialised than charter boat fishers. The results of this study are consistent with those of Ditton *et al.* (1998), who also observed a significantly greater level of general fishing participation and commitment by private boat game fishers compared to charter boat game fishers, using the same item to measure general fishing commitment as was used in this study.

5.4.4 Commitment to game fishing

In relation to the specialisation index applied in the previous chapter, differences in responses to the variable measuring game fishing commitment were observed between advanced and intermediate fishers only; that is, they did not extend to occasional fishers. Accordingly, differences were not hypothesised between private and charter boat fishers. Nonetheless, the lack of difference observed between fisher groups in the current chapter is perhaps counter-intuitive and inconsistent with variables representing other specialisation dimensions (i.e. avidity, experience and skill) and other

variables that may be considered measures of behavioural commitment (i.e. game fishing club membership and boat ownership). As discussed in Chapter 4, responses to the question designed to measure commitment were likely to be confounded by ambiguous interpretations of the response categories. These perceived problems should prompt re-evaluation of the item for future studies, despite being used extensively in previous research (i.e. Ditton et al, 1998; Sutton, 2001; Sutton and Ditton, 2001).

Whilst game fishing boat ownership was not explicitly used as a variable to measure behavioural commitment, the inferences for relative financial commitment to game fishing between the sectors are clear. This claim is also relevant for game fishing equipment[42]. Therefore, specialisation mediated differences in game fishing commitment between angling groups are inferred, and supported by differences in equipment ownership and game fishing club affiliation. Nonetheless, these results need to be viewed in the context of probable sampling bias among private boat fishers whereby only boat owners were sampled.

5.4.5 Social and behavioural profiles and species preferences

In regard to self-assessed game fishing skill levels, the overall greater skill levels reported by private boat fishers appears to be mediated by specialisation. Using the same question format used in this study, Ditton *et al.* (1998) also reported a significantly higher skill level among private boat fishers than charter boat Atlantic bluefin tuna fishers. Private boat fishers in that study also reported a significantly higher level of participation, experience and fishing magazine subscription, suggesting that differences in skill level between sectors were consistent with specialisation theory. Interestingly, about 50% of all anglers surveyed by Ditton *et al.* (1998) rated their skill level higher than "other anglers" compared to less than 10% observed in the current study. While the reasons for this are unclear, it may highlight inherent inconsistencies associated with data based on self-

[42] Personal communication with charter boat operators indicates that only about 5% of patrons use personal fishing gear on fishing trips.

evaluation and personal perception. Therefore, as discussed in Chapter 4, future studies may consider using less subjective measures of skills (and knowledge).

The greater proportion of private boat fishers who fished with fishing club members was consistent with the significantly greater proportion of club members among this group and the results of the previous chapter demonstrating fishing with club members to be a specialisation-mediated behaviour. However, the greater affiliation with family based fishing groups among private boat fishers was unexpected but was supported by a significantly higher level of importance attributed to "family recreation" as a motivational factor by private boat fishers. The results are contrary to what would be expected within a specialisation context (see Chapter 3 Introduction) and according to the only known study that has compared social affiliation between charter boat and private boat fishers (Salz *et al.* 2001b). Using the same motivational scale as the current study, Salz *et al.* (2001b) observed that the item "for family recreation" was one of the few items rated to be of greater importance among 'party' boat fishers. The differences with the current study may be indicative of differences between charter boats and 'party' boats and/or may have broader relevance to issues associated with generalising results between recreational fisheries in general. It is likely that the target species (i.e. flounder, bass and cod) identified by Salz *et al.* (2001b) were more conducive to family-based recreation than the game fish in this study; however, private boat fishers in the same study targeted similar species. Nonetheless, the lack of significance for affiliation with family-based groups in Chapter 4 suggests that the results were mediated by recreational sector, not specialisation. While this observation may indicate important social differences between charter and private boat fishers, friends-only groups were fished with more often than other social groups for both angler types.

Despite a lack of significance for any preferred species, the relative trends between sectors were somewhat consistent with predicted results – and recreational specialisation theory. In particular, the results observed for albacore tuna, yellowfin tuna and mako shark endorse the theory that as

anglers become more specialised through the acquisition of skills, knowledge and experience, they tend to seek greater challenges (Bryan, 1979). In the context of recreational fishing, this may be manifest as a redirection in effort towards the pursuit of more challenging species. The inconsistency of the results with those predicted for bluefin tuna suggest that they were favoured by advanced and intermediate charter boat fishers. However, the results for all species should be viewed within the context that preferences were limited to species that anglers had previously caught. Therefore, the results are also a reflection of which species anglers had caught: this explains the high level of preference for albacore tuna, particularly among charter boat fishers. Without imposing this limitation, it is likely that anglers would prefer to catch the largest species (i.e. striped marlin) despite low chances of capture compared with other species.

5.4.6 Motivations and consumptive orientation

The results for motivational items were consistent with numerous studies suggesting that angler motivations and satisfaction are multi-faceted and require or imply the interaction of catch and non-catch factors (Ditton *et al.* 1978; Spencer, 1993; Fedler and Ditton, 1994; Calvert, 2002). Also consistent with previous research (i.e. Ditton *et al.* 1978; Dawson and Wilkins 1981; Fedler and Ditton, 1994; Wright and Sanyal, 1998; Ormsby and Innes, 1999) was the greater level of importance attributed to non-catch related items. Overall, however, the importance placed on motivations between the sectors was quite similar suggesting that both angling groups were comparably motivated to participate.

As outlined earlier, the decision to only develop hypotheses (from Chapter 4) for survey items whereby significant differences were apparent (and unidirectional) for all three specialisation-based groups precluded the development of any hypotheses for motivational and consumptive orientation items. Nonetheless, for three items – "for family recreation", "adventure and excitement" and "to obtain fish to eat" – whereby significances were observed in both chapters, the results of Chapter 4 will be used to guide interpretation

of the results of the present chapter. The item "for family recreation" was significantly more important for private boat fishers and was also more important for intermediate fishers than occasional fishers. Combined, these findings suggests that for least specialised fishers, a greater proportion of whom fish from charter boats, social recreation with family members was not as important as for intermediate and advanced anglers, most of whom fish from private boats. A similar interpretation may be applied to the item "adventure and excitement"; that is, the motivation was more important for a less specialised subset of predominantly charter boat fishers. As these fishers comprised the least experienced and avid fishers in the study, it is not surprising that they were attracted to elements plausibly associated with the novelty of a new experience.

The items "for relaxation" and "to experience unpolluted natural surroundings" were not found to be affected by specialisation (Chapter 4). Therefore, it is reasonable to assume that differences observed in the current chapter were a product of the mode in which they fished. Nonetheless, "for relaxation" was the highest ranked item for both sectors, despite popular perceptions of game fishing as a pastime grounded in action and excitement. It was also the highest ranked item in a meta-analysis of 17 studies across diverse fisheries by Fedler and Ditton (1984). Reasons for why it was rated significantly higher by private boat fishers are not entirely clear but may be viewed as a 'counter-balance' to the greater importance that charter boat fishers placed on *Excitement and Adventure* items. It is also plausibly consistent with the greater tendency for private boat fishers to fish with family members and the lower catch rates observed for this sector (see Chapter 6). The reason/s for higher mean values given to the item "to experience unpolluted natural surroundings" is unclear due to the lack of difference ascribed to two very similar items in the *Natural Environment* domain. Nonetheless, the difference was not highly significant ($p = 0.049$), suggesting that both sectors were similarly motivated to experience natural surroundings.

The most important catch related item for both sectors was "for the experience of catching fish". This item was also the highest ranked catch-related item for

eight of the seventeen angler motivational studies reviewed by Fedler and Ditton (1984). Of second highest importance among catch related items for private boat fishers, "to obtain fish to eat" was significantly less important for charter boat fishers, and represented the only significant difference among catch related items. The same item was also observed to be significantly less important for occasional anglers than for both intermediate and advanced anglers (Chapter 4). Together, the results suggest that retaining fish is a less important motivator for a less specialised subset of predominantly charter boat fishers. This result was also paralleled in two of the three items in the consumptive orientation domain *Attitudes to Retaining Fish.* As discussed in the previous chapter, these results are inconsistent with specialisation theory; they are also inconsistent with relative rates of fish retention reported in Chapter 6[43]. An explanation for this phenomenon is not obvious, but clearly demonstrates that attitudes to this aspect of game fishing were inconsistent with behaviour. It is plausible that private boat fishers, who on average are more avid and experienced, are also more considered with their responses and are mindful of the importance of retaining a portion of their catch for food as a component of the myriad motivational factors. Conversely, charter boat fishers may not be as highly motivated to catch fish for food as a reason for fishing, or as consciously oriented to retaining fish, but may be less inclined to release fish regardless. It is also possible that the relative inexperience of charter boat fishers may predispose them to the influence of subjective norms imparting a greater degree of variability in the attitude-behaviour nexus when addressing attitudinal questions. Stitt (2004) suggest that subjective norms regarding a behaviour (that is, whether or not the behaviour is the right thing to do) may influence one's attitude to that behaviour even when peers are not present. Proposed reasons for the apparent reluctance of charter boat fishers to release fish (relative to private boat fishers) are discussed in Chapter Six.

Responses to *Attitudes to Catching Fish* consumptive orientation items suggest that for both sectors, catching fish was not a requirement essential to most anglers' perceptions of a successful or satisfying fishing trip. Most

[43] The mean relative percentages of all fish voluntarily retained were 62.3% and 85.2% for private boat and charter boat fishers, respectively.

fishers agreed that a fishing trip could be successful even if no fish are caught and approximately half of all fishers indicated that they would still go fishing if they thought they would not catch a fish. The lack of significant differences for all items suggests that both sectors have similar attitudes to the importance of catching fish on trips. The results reinforce the value of non-catch experiences and support many studies which propose that catching fish is of secondary importance to other benefits received (Ditton *et al.* 1978: Ditton and Fedler, 1989; Peyton and Gigliotti, 1989; Falk *et al.* 1989; Fedler and Ditton, 1994). However, Matlock *et al.* (1988) and Green (1991) contend that standard question formats, such as the ones used to measure motivations and consumptive orientation in this study, routinely underestimate the importance of catch and retention factors. Furthermore, Finn and Loomis (2001) demonstrated that anglers attitudes to catching fish were significantly influenced by their success or failure in catching the size, number or species of fish they most prefer to catch on their last fishing trip.

Members of both sectors demonstrated a preference for catching large fish over catching many fish; an observation consistent with most consumptive orientation studies (Ditton *et al.* 1978; Fisher and Ditton, 1992; Graefe and Ditton, 1997; Wilde *et al.* 1998: Sutton and Ditton, 2001; Hutt and Bettoli, 2007), including studies of game fishers (Fisher and Ditton, 1992; Graefe and Ditton, 1997; Sutton and Ditton, 2001). Based on the characteristics of the prey species, a preference for large fish rather than many fish is intuitive. Nonetheless, charter boat fishers demonstrated a significantly stronger orientation to catching both large fish and numbers of fish than private boat fishers. While the latter observation is consistent with specialisation theory, the non-significant results in the previous chapter suggest that the greater orientation to catching numbers of fish by charter boat fishers was mediated by fishing mode. It is possible that the higher catch rates by charter boat fishers contributed to the results by facilitating attitudes consistent with high catch expectations.

Advanced fishers demonstrated a significantly greater orientation to catching large/trophy fish than intermediate fishers (Chapter 4). While these results

support specialisation theory, the trend did not extend to least specialised fishers who expressed attitudes more closely aligned with advanced fishers. In light of this insight, the significantly greater orientation to catching large fish by charter boat fishers is difficult to interpret but is probably influenced by the greater proportion of occasional fishers within the charter group.

5.4.7 Management preferences and conservation orientation.

Management preferences and conservation orientation may both be viewed as attitudes pertaining to resource sustainability. Therefore, despite different question formats, it would be reasonable to expect similar patterns in the way they were addressed by each angling group. However, this was not the case: awareness of game fish sustainability issues did not differ between angling groups, while charter boat fishers expressed significantly higher agreement with six of the nine (more restrictive) management preferences than private boat fishers. These results were effectively inverse to what was seen in relation to specialisation. Given this finding, it may be tentatively concluded that anglers level of specialisation influenced their concern for game fish sustainability, but their level of agreement with specific management actions (with conservation implications) was influenced by whether they fished from private boats or charter boats. Superficially, the differences between the two measures of 'conservation attitudes' may be explained by the difference in the level of specificity of both measures; that is, the items measuring conservation attitudes were done so in relation to the fishery in general while responses to management preferences were attitudes to specific proposals. While this explanation may account for some of the variability, it is not sufficient in explaining the converse results between the two chapters. In Chapter 4, the absence of relationships between specialisation and management support attitudes were explained in light of anglers' perceived attitudes to custodianship and responsibility towards maintaining a sustainable resource. Given the results of this chapter, anglers' commitment will be used to explain why charter boat fishers exhibited greater support for management attitudes in the following section.

Commitment is the specialisation dimension most closely aligned with conservation orientation. However, measures of *behavioural* commitment - costs and expectations that make activity discontinuation problematic (Scott and Shafer, 2001) - were not incorporated within the specialisation index used in Chapter 4. Due to the clear commitment implications of purchasing boats and specialised equipment required for game fishing, private boat fishers would face greater obstacles in substituting their effort with alternative activities if more restrictive regulations curtailed their participation to the point where insufficient satisfaction was derived from the activity[44]. Conversely, charter boats fishers would face relatively little difficulty substituting game fishing for another activity. The perceived effect of behavioural commitment on private boat fishers' attitudes to regulation changes may be exacerbated if, as proposed in Chapters 4 and 6, fishers felt that local measures promoting sustainability within an international fishery were ineffective or negligible. Accordingly, the results may be an expression of which sector considered themselves to be more disadvantaged under a more restrictive management regime, with implications for activity substitution if additional restrictions made fishing less satisfying. Furthermore, there may be a cynicism among fishers that initial management restrictions may facilitate further restrictions thereafter; this may provide a further impetus to resist more restrictive regulations. While the rationale outlined cannot be confirmed as an explanation of the results in the current study, its plausibility may explain the results of Ditton *et al.* (1998). In their study, private boat tuna fishers (who were more specialised) expressed a significantly lower degree of support for restricting the length of the fishing season and a reduced tuna allocation, than charter boat fishers.

The explanation in the preceding paragraph does not mean to suggest that private boat anglers were motivated by consumption at the expense of stock sustainability. On the contrary, the results demonstrate support for eight of the nine proposals by both sectors. Therefore, it appears that anglers' attitudes to management proposals are a trade-off between a concern for sustainability,

[44] Reluctance to substitute activity was demonstrated to be related to commitment by Ditton and Sutton (2004)

and pragmatism in light of protecting elements of the fishing experience from which the angler derives satisfaction. The overall endorsement of all proposals with the exception of compulsory catch and release for southern bluefin tuna suggests that anglers were largely supportive of measures to reduce impacts by recreational fishers providing scope remained to retain at least one (large) fish. This interpretation may also be relevant for results obtained by Ditton *et al.* (1998). Here, both private boat and charter boat anglers overwhelmingly favoured an option enabling the retention of one bluefin tuna (27"- 73") per boat per day, compared with a catch and release only option plus two *less* restrictive options enabling anglers to retain more and larger fish. In the present study, the one exception to this interpretation is in relation to striped marlin: the majority of anglers from both sectors favoured mandatory release of this species. However, the rarity of this species in Tasmanian waters suggests that most anglers will never catch one. Therefore, the responses to this item may be viewed as largely hypothetical.

5.4.8 Conclusions and future research recommendations

In a strict sense, sector identification cannot be viewed independently from angler specialisation: as discussed in the current and previous chapters, the acquisition of a boat and other equipment required to fish for game species may be interpreted as an expression of behavioural commitment - a key specialisation component. However, by not including boat ownership in the specialisation index used in the previous chapter (an alternative measure of commitment was used), and using sector identification as the focus of exploring heterogeneity in the current chapter, an assessment was able to be made as to whether observed variability was due to specialisation, sector, or both. Nonetheless, the following conclusions should be viewed with reference to potential sampling and non-response biases among respondents from both fishing sectors, as discussed in the previous chapter.

Differences between sectors that were determined to be mediated by specialisation included results pertaining to income, game fishing club membership and species preference, in addition to the variables used to

measure specialisation. These results strengthened the view of boat ownership as a commitment related behaviour to game fishing and provided support for the consideration of behavioural commitment measures to augment more commonly used personal commitment measures in specialisation studies, as suggested by Scott and Shafer (2001). The results also provide support for the notion that boat ownership is not only an expression of commitment, but a limiting factor by which specialisation may be either accelerated or impeded by facilitating or constraining greater participation and challenges. The perceived 'bottleneck' is analogous to a "turning point", which Stebbins (1992: 70) described as a "junction at which the nature or direction of an amateur-professional career is seen by the practitioner as having changed significantly". The greater mean incomes observed for private boat fishers suggests that financial resources may act as "career contingencies" (Stebbins 1992: 70) which facilitate or constrain the progress of individuals along the specialisation continuum.

To comprehensively investigate the existence of an experiential pattern of progression from charter boat fishing to private boat fishing, and the effect of private boat access in facilitating or constraining the specialisation process, longitudinal studies need to be considered. However, in lieu of such studies, the results of the current study suggest that charter boats may provide many participants with their first game fishing experiences. It is further likely that once participants have gained a sufficient degree of experience and competence (and a corresponding level of personal commitment), they may consider purchasing their own boats and equipment capable of game fishing. The evidence for this progression has implications for management – not only for the Tasmanian game fishery but for other fisheries with comparable 'sectors'. First, in the recognition that many fishers may learn practices and behaviours (responsible or otherwise) that may persist later into their fishing careers, management agencies could collaborate with charter boat operators to promote sustainable and responsible fishing practices among their clients. Second, understanding inter-annual charter fishing participation patterns may enable managers to better predict future fishing trends by the private boat sector.

While the observation of several specialisation-mediated differences between sectors provided numerous insights, the greatest potential value of the methodology employed in this chapter was identifying differences between sectors that were not specialisation mediated. These included results pertaining to age, gender, fishing group affiliation, orientation to catching numbers of fish, management preferences and several motivational items. These results indicate that the differences observed were independent from relationships observed across all three specialisation groups from the previous chapter; instead they were mediated by whether respondents fished from a charter boat or private boat. Conversely, some hypothesised differences based on the results from the previous chapter (e.g. conservation orientation) were not supported by the actual results. Together, both sets of results vindicate the methodology applied in this study and suggest that the specialisation theory may not fully encapsulate changes in attitudes and behaviours that are afforded by significant expressions of personal commitment, such as the purchase of equipment required for independent participation.

The results provide additional evidence of the need for further research required to provide context for more effective application of specialisation theory. With regard to the context provided by sector identification, some of the results presented in this chapter may be applicable to fisheries with comparable 'sectors'. Of particular note is the relationship between specialisation and attitudes to restrictive management measures. The results of this study suggest that owning a boat engenders fishers with less supportive attitudes toward restrictive measures – attitudes that weren't consistent with fisher's conservation orientation. These observations were interpreted in light of protecting ones 'investment' (i.e. the financial capital required to provide participants with access to fishing opportunities) and the relative difficulties involved in substituting activities if restrictions make it harder to attain expected outcomes. While this interpretation is plausible, and supported by results from Ditton *et al.* (1998), the implications for the further development of the specialisation theory suggest that financial expressions of behavioural commitment is one area that requires further investigation.

While this section has focused on observed differences, similarities between the sectors were also recognised in this study. Perhaps the most noteworthy were the majority of motivational factors, attitudes to catching fish as a component of a satisfying trip, the mean order ranking of consumptive orientation domains and orientation to conservation. These similarities have management implications for the Tasmanian game fishery as they imply that resource requirements of the two sectors are somewhat similar.

CHAPTER 6

Understanding catch and release behaviour of Tasmanian game fishers

6.1 Introduction

The potential and realised effects of recreational fishing on depleting fish stocks has long been understood and has underpinned the development of recreational fishing regulations. More recently, the practice of releasing fish alive to the water has gained popularity in many fisheries as a way of reducing impacts on fish populations whilst enjoying the experience of catching fish. As such, management agencies, recreational fishing organisations and fishing-based businesses (i.e. guides and charter boat operators) have increasingly been promoting the catch and release philosophy among anglers (Arlinghaus *et al.* 2007).

Due to the perceived value of catch and release fishing as a means of promoting resource conservation, a considerable volume of research has focussed on post-release fish survival (Cramer 2004; Bartholomew and Bohnsack, 2005; Cooke and Schramm, 2007; Skomal, 2007). However, relatively little is understood about anglers within a catch and release context, and the reasons underpinning anglers' decisions to release or retain fish. Accordingly, catch and release fishing is often promoted with little knowledge as to how these efforts will be received by anglers (Ditton and Fedler, 1989; Peyton and Gigliotti, 1989; Sutton, 2001). More effective promotional efforts directed towards anglers who are most likely to be receptive to catch and release fishing will require an understanding of attitudes, motivations and preferences of participants. Such an understanding should also enable greater accuracy in predicting future catch and release participation.

Earlier studies on understanding catch and release behaviour were chiefly descriptive and atheoretical (i.e. Grambsch and Fisher, 1991; Graefe and Ditton, 1997). The results from these studies indicate that a number of

demographic and behavioural variables may be useful in predicting catch and release behaviour; however, the lack of a theoretical framework offered little insight into the causative mechanisms influencing angler's decisions to release (or retain) fish. Furthermore, there were inconsistencies by which 'catch and release anglers' were classified between the two studies. In their study of trout and bass anglers, Grambsch and Fisher (1991) classified catch and release fishers as those who had voluntarily released *any* fish over a 12 month period. Conversely, Graefe and Ditton (1997) classified catch and release fishers as those who released *all* billfish caught over a 12 month period. While the different classifications of catch and release fishers reflect differences in the respective target species, neither classification encompassed anglers who voluntarily release fish some of the time. Additionally, the methodologies used did not permit an evaluation of the influence of factors unique to individual fishing trips on fish release behaviour.

To advance the understanding of catch and release behaviour, Sutton (2001: 4) developed a comprehensive definition of catch and release behaviour and a theoretical framework to understand the behaviour. He defined catch and release behaviour as "a specific behaviour (i.e. live release of an angled fish) that is under volitional control of the angler" (p.4). This definition assumes that catch and release is a voluntary behaviour and precludes the mandatory release of fish adherent to fishing regulations. The definition also provides scope for the decision to release or retain fish to be made prior to engaging in fishing activity or at the time of fish capture. Sutton (2001) suggested that defining catch and release as a voluntary action facilitates research on predictors of fish release or retention in any given situation as well as the effect of such predictors on the relative frequency of catch and release behaviour over time.

Sutton's (2001) theoretical approach to understanding catch and release behaviour was derived from social psychology and leisure science research. The framework assumes that the immediate determinants of catch and release decisions are an angler's attitudes, beliefs, values and knowledge. These are assumed to be a function of personal attributes of an angler which include

social and psychological factors that exist independently of the circumstances of individual fishing trips. Furthermore, Sutton (2001) hypothesised that catch and release decisions are also affected by situational factors, which are attributes of the situation in which catch and release decisions are made (for example, size and species of fish, number or nature of fishing companions). These are thought to affect the catch and release decision by influencing the salience of the angler's beliefs, attitudes, knowledge and values. Sutton (2001) tested this framework in a series of studies on anglers targeting bluefin tuna (Sutton and Ditton, 2001), billfish (Sutton, 2001) and bass, crappie and catfish (Sutton, 2003). The results obtained through these studies indicated general support for the framework.

In his series of studies, Sutton proposed that anglers demonstrating a greater commitment to fishing (measured as indices incorporating variables relating to experience and centrality to lifestyle), and anglers with a lower consumptive orientation to fishing should be more likely to release fish. In two of the three studies outlined above, centrality to lifestyle index values were significantly related to catch and release behaviour, while experience index values were not significant for any of the studies. Furthermore, only one consumptive orientation domain – attitudes to retaining fish – was consistently found to have a significant relationship with catch and release behaviour. In relation to situational variables, Sutton and Ditton (2001) observed that the odds of releasing a fish were related to the number of fish caught and fishing party size, while Sutton (2003) found that species type and fish size were also significant predictors of fish release behaviour.

6.1.1 Study objectives

While the studies described above advanced the understanding of catch and release behaviour appreciably, many potential personal and situational predictors remain untested. Furthermore, varying results between the three populations studied by Sutton invoke caution in generalising results to other angling populations. Accordingly, the present study examines a suite of personal and situational variables, some which have been previously used and

some that have not, to describe catch and release behaviour of game fishers in a mixed species fishery. The personal variables considered pertain to five categories: specialisation, demographics, consumptive orientation, conservation orientation and attitudes to catch and release fishing. Situational variables used were the number of fish caught, prior fishing activity during the season and whether or not fish were caught as part of a fishing tournament. The results will be discussed with reference to the framework developed by Sutton (2001). In doing so, the positioning of previously untested variables within the framework, and the validity/appropriateness of the framework to explain the influence of previously tested variables will be discussed. From these discussions, and in light of limitations imposed by the methodologies employed in this study, an agenda for further research on understanding catch and release behaviour of fishers will be suggested. First, however, the variables used in this study will be discussed in light of relevant research, and their relationship with catch and release behaviour will be predicted.

6.2 Literature review

6.2.1 Specialisation related variables

The concept of recreational specialisation has been used to explore many facets of angling populations and was used to explore diversity among Tasmanian game fishers in Chapter 4. As a key principle of specialisation, Bryan (1977) suggested that as anglers become increasingly specialised, their focus shifts from fish consumption to fish preservation. Accordingly, Bryan proposed that more specialised fishers should be more receptive to the catch and release philosophy. As an extension of this theory, Sutton (2003) posited that "anglers for whom fishing is an integral part of their lifestyle are motivated to practice catch and release as a conservation measure to ensure fishing opportunities will be available in the future". Support for this sentiment is also apparent within outdoor recreation research that does not explicitly focus on recreational specialisation, nor recreational fishing. For example, in their paper on the predictive validity of environmental attitudes, Tarrant and Green (1991: 18) noted "a strong attachment to outdoor recreation

activities can manifest itself as a responsibility to preserve attributes of the environment that contribute directly to the enjoyment of that activity".

Various studies have concurred with these sentiments by demonstrating greater support for catch and release regulations by highly specialised fishers (Chipman and Helfrich, 1988; Gigliotti and Peyton, 1993; Salz *et al.* 2001a; Oh and Ditton, 2006; Kyle *et al.* 2007). As these studies used a single measure of specialisation (i.e. an index or a surrogate measure), the effects of specific sub-dimensions of specialisation were not evaluated. Comparatively fewer studies have focussed on the link between recreational specialisation and actual catch and release behaviour (Graefe and Ditton, 1997; Sutton 2001; Sutton and Ditton, 2001). While these studies did not seek to understand the relationship between catch and release behaviour and specialisation *per se*, two specialisation sub-dimensions – behaviour and commitment – were used as independent variables. Sutton (2001) and Sutton and Ditton (2001) observed that fish release behaviour was positively related to measures of personal and behavioural commitment to fishing that were used in an index. The items used were the importance of fishing relative to other outdoor activities, the number of fishing related organisation memberships and the number of fishing related magazine subscriptions. In relation to the behavioural dimension of recreational specialisation, no significant relationships were observed in any of Sutton's studies for angling experience or avidity, contrary to predictions. In an earlier study, Graefe and Ditton (1997) observed that fish release behaviour of billfish anglers was positively related to experience in saltwater angling but not billfish angling.

To my knowledge, studies have not assessed the relationship between fish release behaviour and the skills and knowledge sub-dimension of specialisation. Sutton (2001) and Sutton and Ditton (2001) used a self evaluated skill level (relative to other fishers); however, it was embedded within a four item index developed to measure commitment. As such, its effect as an individual variable cannot be assessed. Nonetheless, as a specialisation sub-dimension, skills and knowledge relating to game fishing are expected to be significant predictors of fish release behaviour in

accordance with the theory posited by Bryan (1977), above. In relation to the knowledge component, this expectation is further supported by studies that have demonstrated a link between understanding issues surrounding one's impact on a resource and the development of pro-environmental behaviours (i.e. Stern *et al.* 1995; Schiller *et al.* 2001).

6.2.2 Consumptive orientation

Sutton and Ditton (2001: 52) defined consumptive orientation as "the degree to which an angler values the catch related outcomes of the fishing experience". The concept was originally advanced as a scale developed by Graefe (1980) and refined in later studies (Ditton and Fedler, 1984; Fedler and Ditton, 1986; Fisher, 1997; Anderson *et al.* 2007). The scale was designed to measure the importance of fishers' attitudes to catching fish, catching numbers of fish, catching large/trophy fish and retaining fish. Consumptive orientation accords with the multiple satisfactions framework proposed by Hendee (1974) which recognises that the importance of pursuing, catching and retaining fish varies between individuals; for some anglers, these catch related aspects of the fishing experience may be a means to attain other satisfying experiences.

Fedler (2002) classified fishers within discrete groups based on their responses to statements designed to depict their harvest orientation. Groups were then compared in their responses to motivational and management related statements. Fedler (2002) concluded that the fundamental difference between harvest oriented and release oriented angler's lies in their consumptive orientation. Other studies that have examined the relationship between consumptive orientation and support for management options with implications for catch and release fishing have yielded similar results (Aas and Kaltenborn, 1995; Fisher, 1997). In reference to three studies undertaken to determine the predictive capacity of consumptive orientation on actual fish release behaviour, Sutton (2001: 12) proposed that "individuals who place relatively low importance on the various catch related aspects should be more receptive to the catch and release philosophy than those who place high

importance on these aspects because satisfaction for low consumptive anglers is not highly dependent on catching and/or keeping fish". However, only one consumptive orientation domain – attitudes to retaining fish – demonstrated a significant (inverse) relationship with catch and release behaviour across all three studies (Sutton, 2001; Sutton and Ditton, 2001; Sutton, 2003). In light of these results, Sutton (2001: 84) suggested that "these dimensions tap into attitudes that are largely unrelated to keeping or releasing fish". Two motivational items used by Hunt *et al.* (2002) were similar in scope to the attitudinal domain relating to retaining fish and were also found to be significant predictors of catch and release behaviour: "to take home your limit of fish" and "to catch and release many fish".

The results observed by Sutton and Hunt *et al.* (2002) were intuitive given that anglers attitudes to retaining fish would be expected to relate directly to catch and release behaviour. As such, similar results are predicted for the current study. In relation to the other domains, they are not expected to have an appreciable effect on fish release behaviour.

6.2.3 Conservation orientation

Arlinghaus (2005) suggested that anglers are motivated to practice voluntary catch and release to preserve fish for the sake of fish populations or for future fishing opportunities. Either way, the promotion and adoption of the catch and release ethos is underpinned by the perceived need to minimise impacts on fish populations, thereby sustaining future stocks. Therefore, it is intuitive to hypothesise that an angler's propensity to voluntarily release fish will be related to his or her attitudes to fish conservation. According to Sutton's (2001) framework of catch and release behaviour, one's conservation orientation should influence angler's decisions by influencing behavioural antecedents i.e. relevant attitudes, beliefs, values and norms. Despite the presumed centrality of anglers' conservation attitudes to the catch and release ethic (Policansky, 2002), little work has been undertaken to assess its relationship to fish release behaviour.

Previous studies of anglers have used support for restrictive management proposals as measures of conservation orientation (Chipman and Helfrich, 1988; Fisher, 1997; Salz *et al.* 2001; Oh and Ditton, 2006). In the only study located that has examined the relationship between conservation orientation and catch and release, Wallmo and Gentner (2008) assessed the relationship between support for three fisheries regulations - minimum size limits, maximum size limits and possession limits – and intentions to release or retain fish. Support for each of these regulations was positively related to intended fish release behaviour. However, no studies have compared conservation orientation with actual release behaviour. In reference to his three studies on understanding catch and release behaviour, Sutton (2001: 92) suggested "there is an important conservation orientation dimension underlying catch and release behaviour that needs to be further explored as a predictor of catch and release".

6.2.4 Socio-demographic characteristics

If catch and release behaviour is linked to socio-demographic factors, the potential usefulness for fisheries managers are apparent. For managers to utilise the results of these types of studies, identifying segments of the angling population who are more or less likely to practice catch and release fishing by demographic indicators is potentially less problematic than using other indicators.

Three key studies on understanding catch and release behaviour that have used demographic measures as independent variables have all identified significant demographic predictors (Grambsch and Fisher, 1991; Graefe and Ditton, 1997; Wallmo and Gentner, 2008). Grambsch and Fisher (1991) observed a positive relationship between catch and release participation of trout and bass anglers and both education level and income. A higher income was also found to increase the likelihood of releasing all billfish caught over a 12 month period by Graefe and Ditton (1997). They also observed significant relationships with residential status (United States compared to Puerto Rico) and fishing club membership and release behaviour. However, significant

relationships were not observed for education level or gender. More recently, Wallmo and Gentner (2008) observed a significant relationship between education and intended release behaviour in a stated preference model: higher education levels tended to increase the probability of releasing a fish.

The demographic variables used in this study were age, income, and game fishing club membership. Based on previous research, fish release behaviour is predicted to be positively related to income and club membership; however, no prediction for age is given.

6.2.5 Attitudes to catch and release

According to the conceptual model of voluntary catch and release behaviour proposed by Sutton (2001), the act of releasing or retaining fish is directly influenced by attitudes and subjective norms concerning the release or retention of fish. These are hypothesised to be functions of personal factors such as one's experience, commitment, consumptive orientation and conservation orientation. Therefore, fish release behaviour should be more closely related to attitudes to catch and release than to personal factors thought to influence behaviour indirectly. However, studies that have compared stated preferences with actual behaviour have reported mixed results (i.e. Adamowitz *et al.* 1994; Haener *et al.* 2001; Heshner *et al.* 1994). Fishbein and Ajzen (1975) suggest that the strength of the attitude-behaviour relationship should depend on the compatibility in the level of specificity at which behaviours and attitudes are measured. For example, an attitudinal measure relating to a particular species should be a stronger predictor (for that species) than an attitudinal measure relating to fish in general.

In relation to the conceptual model described above, Sutton and Ditton (2003) demonstrated that measures of behavioural commitment and the consumptive orientation domain relating to the importance anglers placed on keeping fish were significant predictors of catch and release attitudes of Atlantic bluefin tuna fishers. (The latter was measured as a level of support for the introduction of mandatory catch and release of bluefin tuna). However, the

attitudinal measure was not used as a predictor variable to understand fish release behaviour. Graefe and Ditton (1997) used a similar measure of attitude to catch and release (that is, support for the introduction of mandatory catch and release of billfish) and found it to be a significant predictor of whether or not anglers had released any billfish over a 12 month period. Furthermore, Wallmo and Gentner (2008) observed that angler's attitudes relating to catch and release practices and the importance of fish as food were highly significant predictors of intended catch and release behaviour.

While two of the three studies described above used angler's level of support for catch and release based regulation changes to represent attitudes, the importance an individual ascribes to a behavioural based motivational item may also be seen as an attitude relating to that behaviour. In relation to behaviour, Ajzen (1991: 188) described an attitude as "the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question". Hunt *et al.* (2002) used three motivation-based attitudes as predictors of fish release behaviour for three freshwater species. They found that the items "to take home your limit of fish" and "to catch and release many fish" were significant predictors of release behaviour for three and two species, respectively. However, a third item "to keep fish for consumption" was not a significant predictor for any of the species.

6.2.6 Number of fish caught

In the current study, the relationship between the number of fish caught and the likelihood of voluntarily releasing a fish on a fishing trip was examined. A significant relationship is predicted as the likelihood of releasing a fish should increase with each additional fish caught on a trip. This view is underscored by the assumption that many fishers will retain a portion of their catch before voluntarily releasing fish within possession limits for a species. A similar relationship between fish caught and fish release behaviour was observed by Graefe and Ditton (1997) across all billfish trips undertaken within a 12 month period. In their study on Canadian freshwater anglers Hunt *et al.* (2002) predicted that the *proportion* of released fish to retained fish should

increase with a greater number of fish caught based on the reasoning outlined above. While their results supported their prediction, the study did not distinguish between voluntary and mandatory releases. Sutton and Ditton (2001) reported a significant *inverse* relationship between the likelihood of releasing a tuna the number of fish caught. However, only one fish was allowed to be retained per boat, regardless of the number of fishers on the boat. As such, it may be assumed that retained fish were commonly shared among all fishers, and a higher number of fishers on the boat increased the theoretical demand for a fish to be retained.

6.2.7 Prior game fishing activity during the fishing season

Within the context of a fishing season, the effects of prior fishing activity on catch and release behaviour do not appear to have been examined. In this study, it is anticipated that the tendency for anglers to retain fish will decrease progressively with the number of fish caught and kept throughout the fishing season. Due to the limited length of the game fishing season, fishers may be more focused on catching fish for food early within their involvement in the fishing season as this may represent the first opportunity that anglers have to consume game fish for many months. As most game species are relatively large, it is further likely that some retained fish will be frozen for later use, reducing the inclination to retain additional fish on subsequent trips.

This expectation is consistent with the satiation-deprivation proposition developed by Homans (1974). Homans suggested that when a reward is received frequently, the value of receiving it will decrease, possibly to the point where the recipient may become temporarily indifferent to it and is consistent with the economic concept of diminishing marginal utility. According to this theory, Loomis and Fix (1998) suggested that (within a limited period of time), each additional fish caught adds less satisfaction than the previously caught fish. Finn and Loomis (2001) demonstrated that the reverse situation is generally true if anglers' catch expectations are not satisfied. In their study, trout anglers placed a higher degree of importance on catching fish on subsequent trips if they did not succeed in catching their

preferred size, numbers or species on previous trips. In the current study, it is predicted that the satiation-deprivation hypothesis applied to the importance of catching fish will, by extension, also apply to the importance of retaining fish. Of course, if the number of trips where fish were caught and not caught were roughly even, effects may be hard to distinguish as deprivation-mediated effects could be 'neutralised' by satiation-mediated effects. However, in this study, fish were caught on most trips for both sectors (84% of charter boat trips and 77% of private boat trips), providing a good opportunity to test the 'retention satiation' hypothesis.

6.2.8 Tournament participation

A considerable volume of research has evaluated participation, motivations, attitudes and socio-demographic characteristics of fishing tournament participants (Ditton and Loomis, 1985; Loomis and Ditton, 1987; Falk *et al.* 1989; Ditton and Fisher, 1990; Antia *et al.* 2002; Oh *et al.* 2007). While results vary between species and situations, tournament anglers generally appear to be more motivated by catch-related factors than non-tournament anglers. However, the general consensus also suggests that tournament anglers are usually less motivated to retain fish. Catch and release principles are often promoted through fishing clubs and organizations that operate fishing tournaments, resulting in a greater commitment to low impact fishing practices (Ditton and Stoll, 2003; Oh *et al.* 2007). Furthermore, clubs and associations that organize tournaments often impose catch regulations that are more restrictive than those imposed by management agencies. This is true for all four clubs affiliated with the Tasmanian Game Fishing Association (TGFA). Accordingly, trips taken during fishing tournaments are expected to demonstrate a higher incidence of voluntary release behaviour.

6.3 Methods

Data were collected from charter and private boat fishers in separate surveys. Data from charter fishers were collected through a mail questionnaire distributed by co-operating charter boat operators. For private boat fishers, data were collected through three separate but inter-related surveys – a mail

questionnaire, a telephone/diary survey and a telephone survey[45]. Summary details of individual variables collected by each of the surveys are provided in Table 6.1.

For both private and charter boat fishers, logistic regression models were used to examine the effects of personal and situational factors on voluntary fish release behaviour of anglers. However, due to the differences in survey designs and variations in the way data were collected, it was necessary to take a different approach in structuring the respective models for charter and private boat fishers. Both personal and situational variables were used in the same predictive model for charter fishers whereas for private boat fishers, separate predictive models for the two classes of variables were used. Reasons for these differences are explained below.

Table 6.1. Statistical summary of independent variables used for both angling groups

		Charter Boat Fishers	Private Boat Fishers
Continuous Variables[a]	**P/S[b]**	**Mean/Median**	**Mean/Median**
INCOME	P	$50-60K	$60-70K
AGE	P	41.9	45.7
SKILLS	P	1.6	1.8
AVIDITY	P	3.3	7.6
EXPERIENCE	P	2.6	3.7
KNOWLEDGE	P	N/A	2.7
COMMITMENT-P	P	3.1	3.3
COMMITMENT-B	P	N/A	$2,818
CONSUMPTIVE-1	P	3.23	3.38
CONSUMPTIVE-2	P	2.92	3.22
CONSUMPTIVE-3	P	2.81	2.45
CONSUMPTIVE-4A	P	1.9	2.3
CONSUMPTIVE-4B	P	2.4	2.7
CONSERVATION-1	P	2.4	2.6
MOTEAT	P	3.1	3.2
MOTCR	P	N/A	2.6
C&RPROMOTE	P	2.9	2.7
SBTRELEASE	P	1.6	1.3
DFBT	S	1.2	4.4
FCBT	S	N/A	14.5
FKBT	S	N/A	7.3
SPECIESCAUGHT	S	1.6	1.6
FISHCAUGHT	S	7	5.9
FISHCAUGHTBOAT	S	N/A	20.3

[45] See chapter 3 for detailed information on survey design and implementation

Categorical Variables		Most Popular Category	% in Category	Most Popular Category	% in Category
CLUB	P	non-club	93.1	non-club	61.1
CONSERVATION-2	P	C oriented	57	C oriented	58.8
CONSERVATION-3	P	non C oriented	76.5	non C oriented	82.1
TOURNAMENT	S	N/A	N/A	no	77.7

[a] See text in the following section for expanded definitions of continuous and categorical variables

[b] P = personal variables, S = situational variables

Charter boat fishers

In the charter boat fisher's questionnaire, data were collected regarding an individual's orientation to the Tasmanian game fishery (that is, motivations, consumptive orientation, attitudes to management etc) in addition to specific details about one game fishing trip. Data were collected from 177 charter fishers: these represented 177 fishing trips incorporating 185 fishing days. As only one trip per angler was used for analysis, both personal and situational variables were incorporated in a single regression model. This approach is consistent with previous studies on understanding catch and release behaviour (Sutton and Ditton, 2001; Hunt *et al.* 2002; Sutton, 2003).

Private boat fishers

Through the telephone/diary survey, detailed trip information was collected for *all* trips undertaken during the entire game fishing season (January – July, 2007). From 100 anglers surveyed, details were collected for 451 fishing trips incorporating 740 fishing days. As there was considerable variation in the number of trips undertaken between individuals, applying the same approach used for charter boat fishers would have resulted in pseudoreplication from a greater representation by avid anglers. Therefore, two separate regression models were required that allowed situational (i.e. trip related) data to be assessed at the trip level and personal data to be assessed at the level of the angler. The different treatment of the models between the sectors needs to be considered when interpreting results.

6.3.1 Dependent variables

Catch and release behaviour (trip)

The catch and release behaviour variable for individual trips (CRB-T) was developed to represent voluntary fish release behaviour of charter boat fishers. It was also used as the dependent variable for private boat fishers in the situational variables model. The CRB-T is a binary variable distinguishing trips in which a game fish was voluntarily released from trips where no fish were voluntarily released. Voluntarily released fish were considered to be fish that were returned to the water whilst the possession limit for that species had not been attained. Care was exercised to distinguish between voluntarily released fish with fish that were released involuntarily: the latter indicates compliance with possession limits, and not a demonstration of volitional catch and release behaviour. No size limits (or other qualitative restrictions) existed for game species at the time of the surveys. Therefore, any fish released within the possession limit were assumed to be done at the discretion of the angler.

As data cases were assessed at the level of 'trip' and not 'fishing day', minor changes were made to some data to ensure integrity in light of possession limits[46]. Possession limits applied to all fish in an angler's possession, regardless of when fish were caught. Therefore on multi-day trips where possession limits were attained or exceeded, and fish were also released, it was not possible to determine whether fish were released voluntarily or involuntarily. Accordingly, an assumption was made that the three smaller species (albacore, striped tuna and yellowtail kingfish) could plausibly be consumed during a multi-day trip, providing scope within the possession limit to retain more fish. However, a decision was also made that the larger species (SBT, yellowfin tuna, mako shark, blue shark) could not. As such, for smaller species, a decision was made to omit entries on multi-day trips where fish were released after the possession limit was attained. This decision also resulted in the omission of six multi-day trip entries.

[46] Angling regulations at the time of the surveys stipulated that anglers may not exceed possession limits for individual species (albacore tuna =10, striped tuna=15, southern bluefin tuna=2, yellowfin tuna=2, mako shark=2, blue shark=2, yellowtail kingfish=15).

Catch and release behaviour (season)

As mentioned, the effects of personal and situational variables on catch and release behaviour were assessed in separate regression models for private boat fishers to avoid pseudoreplication of data. In the personal variables model, catch and release behaviour of each angler was represented as a single value in the personal variables model. For anglers who caught fish on more than one trip, this involved dividing the total of all CRB-T values (i.e. 1 and 0) by the number of trips undertaken in which fish were caught. This resulted in a value between 0 and 1, and will hereafter be referred to as CRB-V. To enable the use of logistic regression, as per the other models, the population was then divided into two groups, separated by the median value (0.49)[47]. The respective groups were thus representative of anglers who voluntarily released fish on 50% or more of trips and fishers who voluntarily released fish on less than 50% of trips.

For both sectors, trips were omitted from analysis if no fish were caught. As a result, the number of trips used for analysis by charter fishers and private boat fishers was 149 and 346, respectively. The number of fishing days represented by these trips was 157 and 574 for charter and private boat fishers respectively. The data omissions also resulted in the removal of anglers from the data set: of the 177 charter fishers and 100 private boat fishers who supplied data, data for 149 and 94 fishers were retained. Of the fishing trips eligible for analysis, fish were voluntarily released on 36.9% and 57.8% of trips for charter and private boat fishers respectively. A comparison of fish numbers caught and voluntary release rates for individual species are presented in Table 6.2.

[47] A dependent variable that distinguished between fishers who released all fish, some fish and no fish over the course of the fishing season was considered. While this approach would have been amenable to analysis by ordinal logistic regression, the negligible number of fishers who released all fish on all trips would have negated any potential benefits of using a more comprehensive dependent variable

Table 6.2. Comparison of fish numbers caught and voluntary release rates between angling groups

	Charter Boat Fishers		*Private Boat Fishers*	
	Number of Fish Caught	% Voluntarily Released	Number of Fish Caught	% Voluntarily Released
Albacore Tuna	433	5.5	1116	27.8
Striped Tuna	512	36.8	712	66.0
Southern Bluefin Tuna	78	13.0	92	26.1
Yellowfin Tuna	17	0	45	22.7
Mako Shark	10	0	30	28.6
Blue Shark	1	0	21	75.0
Yellowtail Kingfish	17	0	34	0
All Species	1068	14.8	2050	37.7

6.3.2 Independent variables (personal)

Specialisation related variables

To be consistent with contemporary approaches to measure specialisation (i.e. Lee and Scott, 2004; Oh *et al.* 2005; Oh and Ditton 2006; Oh and Ditton, 2008), and with Chapter 3, the concept will be operationalised as comprising three sub-dimensions: behaviour, commitment, and skills and knowledge. (See this Chapter for an overview of specialisation sub-dimensions).

Avidity (AVIDITY) was measured as the number of days spent game fishing over a twelve month period, irrespective of whether other types of fishing were also undertaken on days spent game fishing.

Respondents were asked to disclose which of the eight focal species they had *ever* caught (in Tasmanian waters). This was used as a proxy for experience (EXPERIENCE) based on the assumption of a positive relationship between the amount of time spent fishing and the opportunity of catching a 'new' species.

Personal commitment (COMMITMENT-P) was measured by asking respondents to indicate the level of importance they ascribed to game fishing compared to other types of fishing they participate in from the following four categories: "my only type of fishing", "my most important type of fishing", "my second most important type of fishing", and "only one of many types of fishing that I do". These were sequentially coded between 1 and 4 for use as

nominal scale data. Behavioural commitment (COMMITMENT-B) was measured as the amount of money spent over a 12 month period on non trip-related game fishing expenses[48]. This variable was used for private boat fishers only.

Respondents were asked to assess their game fishing skills (SKILLS) by comparing them to "other game fishers". Three response categories were offered: "less skilled", "equally skilled", and "more skilled". These were sequentially coded between 1 and 3 for use as nominal scale data.

Respondents were asked to evaluate their level of knowledge (KNOWLEDGE) of game fish sustainability on a four point scale from poor (1) to excellent (4). The following response categories were offered: "poor", "adequate", "good" or "excellent". Responses were sequentially coded for use as nominal scale data. This variable was used for private boat fishers only.

Demographic characteristics

Three demographic measures were used as independent variables; age (AGE), income (INCOME), and game fishing club membership (CLUB). AGE and CLUB were used as continuous and categorical variables, respectively. Annual personal income ($AUS before tax) details of respondents were collected as categorical data. With the exception of the lowermost (< $20,000) and uppermost (> $100,000) income categories, data were segmented into $10,000 income categories. Accordingly, ten response categories were used.

Consumptive orientation

Consistent with previous studies (Graefe, 1980; Ditton and Fedler, 1984; Fedler and Ditton, 1986; Fisher, 1997; Sutton and Ditton, 2001; Anderson *et al.* 2007), consumptive orientation was represented by four attitudinal domains relating to: *Catching Fish* (CONSUMPTIVE-1); *Catching Numbers of Fish* (CONSUMPTIVE-2); *Catching Large/Trophy Fish*

[48] For expenses that may also be attributed to activities other than game fishing, expense data were subject to an attribution procedure to differentiate the respective expense proportions. See Chapter 3 for more information.

(CONSUMPTIVE-3) and *Retaining Fish*. These domains encompassed thirteen items (Table 6.3). For each item statement, respondents were asked to rate their level of agreement on a five point scale from 'strongly disagree' (1) to 'strongly agree' (5)[49].

Table 6.3. Descriptive statistics and reliability analysis for consumptive orientation domains and items for data pooled between private boat and charter boat fishers

Domains and Statements	Mean	SD	Item-total Correlation	α if item deleted
Attitudes to Catching Something (α = 0.78)				
A fishing trip can be successful even if no fish are caught[a]	2.19	1.05	0.51	0.70
I'm just as happy if I don't catch a fish[a]	2.89	1.09	0.61	0.71
If I thought I would not catch fish, I would not go fishing	2.74	1.23	0.58	0.73
I'm not satisfied unless I catch at least something	3.00	1.14	0.65	0.69
Attitudes to Catching Numbers of Fish (α = 0.70)				
The more fish I catch the happier I am	3.04	1.08	0.54	NA
A successful fishing trip is one where many fish are caught	2.86	1.14	0.54	NA
Attitudes to catching large/trophy fish (α = 0.64)				
I would rather catch 1 or 2 big fish than 10 smaller fish	3.71	1,10	0.42	0.56
The bigger the fish I catch the better the fishing trip	3.32	1.05	0.47	0.53
I'm happiest when I catch a challenging fish	4.24	0.79	0.38	0.60
I like to fish where I know I may catch a trophy fish	3.09	1.21	0.41	0.58
Attitudes to Retaining Fish (α = 0.67)[b]				
I'm just as happy if I release the fish I catch[a]	2.44	0.95	0.51	NA
I want to keep all the fish I catch	2.05	0.94	0.51	NA

[a] Statement responses reversed for scale calculation and reliability analysis

[b] The statement "I usually eat the fish I catch" was removed to improve internal consistency of scale

Items in each of the four domains were summed to calculate an index for each domain. Reliability analyses determined that for two domains - *Catching Large/Trophy Fish* and *Retaining Fish*[50] - Cronbach's coefficient values were slightly less than the threshold value of 0.70 recommended by Pallant (2007). Accordingly, and in recognition of the theoretical centrality of the latter domain to catch and release behaviour, a decision was made to use the two item statements as individual variables instead of using an indexed value for *Retaining Fish*. The two item statements were 'I'm just as happy if I release the fish I catch" (CONSUMPTIVE-4A) and "I want to keep all the fish I catch" (CONSUMPTIVE-4B). However, as the domain *Catching*

[49] A sixth response category, "unsure" was also used. However, due to the low number of responses, data were excluded from analysis.

[50] The item "I usually eat the fish I catch" was omitted from the domain to improve index reliability.

Large/Trophy Fish was less central to the theoretical framework, analyses proceeded at the domain level.

Attitudes to releasing fish

Four variables were used to depict angler's attitudes to releasing and retaining fish. The variables C&RPROMOTE and SBTRELEASE were measures of agreement with promoting catch and release fishing and mandatory catch and release of southern bluefin tuna, respectively. Both were measured on a five point scale from 'strongly disagree' (1) to 'strongly agree' (5)[4]. For the other two variables, respondents were asked to evaluate the importance of the motivational items "to obtain fish to eat" (MOTEAT) and "to participate in catch and release fishing" (MOTC&R) on a five point scale from 'not at all important' (1) to 'extremely important' (5). The latter motivational item was used for private boat fishers only.

Conservation orientation

Three variables were used to represent individual's orientation to fish conservation. An index of response values to seven management proposals (CONSERVATION1) was developed. All proposals were more restrictive than those prevailing at the time of the survey (Table 6.4). Agreement levels were expressed on a five point scale from 'strongly disagree' (1) to 'strongly agree' (5)[4]. Reliability analysis on pooled data revealed a Cronbach's alpha score of 0.87 suggesting very good internal consistency across the scores (Pallant, 2007).

The other two variables were developed from responses to the open-ended question "*What do you think is the most important issue facing the recreational game fishery in Tasmania*". Responses were collapsed into a binomial variable (CONSERVATION2) assigning anglers to one of two categories: a 'conservation oriented' category and a 'non-conservation oriented' category. To qualify as conservation oriented, respondents needed to acknowledge the need to sustain fish stocks and/or preserve the aquatic environment in their response. A closer inspection of conservation oriented responses revealed a considerable number that attributed all perceived threats to game fish viability to sources other than recreational fishing – for example,

commercial fishing or pollution. Accordingly, a second binomial variable (CONSERVATION3) was developed to distinguish between responses acknowledging potential impacts of recreational fishing on game fish stocks and those who did not.

Table 6.4. Descriptive statistics and reliability analysis for proposed management scenarios for data pooled between private and charter boat fishers

Management Proposals ($\alpha = 0.87$)	Mean	SD	Item-Total Correlation	α if item deleted
Southern bluefin tuna to be catch and release only	3.25	1.31	0.61	0.86
Striped marlin to be catch and release only	2.51	1.22	0.49	0.87
A personal combined possession limit of 1 bluefin or yellowfin tuna	2.39	1.28	0.65	0.85
A personal combined possession limit of 1 mako shark or blue shark	1.98	1.08	0.72	0.85
Gamefish possession limits for boats	1.91	1.02	0.68	0.85
A personal possession limit of 5 albacore	2.36	1.23	0.48	0.87
A minimum size limit for albacore tuna	1.98	1.12	0.63	0.86

6.3.3 *Situational variables*

Prior game fishing activity during the season

Three continuous variables were used as measures of game fishing activity during the season prior to the fishing trip surveyed: the number of days fished before the trip (DFBT); the number of game fish caught before the trip (FCBT); and the number of game fish kept before the trip (FKBT). Only data for the number of days spent game fishing before the trip were available for charter boat fishers.

Tournament / non-tournament trip

A binomial variable (TOURNAMENT) distinguished between trips that where undertaken as part of a fishing tournament and those that were not. This variable was only used for private boat fishers.

Number of fish caught

Two continuous variables were created to represent the number of fish caught: the number of fish personally caught by the respondent (FISHCAUGHT) and the number of fish caught by all fishers on the boat (FISHCAUGHTBOAT). Due to differences in the data collection process, the latter measure was able

to be used for private boat fishers only. The number of game species caught on trips (SPECIESCAUGHT) by respondents was also used as a continuous variable.

6.3.4 Analysis

A two-tiered analysis was used to identify personal and situational predictors of catch and release behaviour. In the first tier, relationships were identified between independent variables and the relevant dependent variable. To do this, correlation analysis and chi-square tests were used for continuous and categorical data, respectively. All variables found to be significant qualified for inclusion in the relevant regression model. The level of significance was set at 0.10 to avoid excluding important predictors of catch and release behaviour from subsequent analysis.

In the second tier of analysis, three logistic regression models were used to test the effects of the independent variables on the odds of an angler voluntarily releasing a fish. The model used for charter boat fishers incorporated both personal and situational variables. For private boat fishers, separate models were used for personal and situational variables. Interpretation of the models is based on the odds ratio. The odds ratio is the probability of predicting behaviour at one level of an independent variable divided by the probability of predicting behaviour at a lower level of that independent variable. A ratio greater than one suggests that the odds of a measured behaviour (that is, the voluntary release of a fish) is a positive function of the independent variable. Conversely, an odds ratio less than one suggests that the odds of releasing a fish is a negative function of the independent variable. The further the odds ratio is from one, the stronger the association between the dependent and independent variable.

6.4 Results

6.4.1 Predicting voluntary release behaviour of charter boat fishers

During preliminary analysis, five of the 23 independent variables demonstrated a significant relationship with voluntary release behaviour. Two

were personal variables (INCOME and SKILL) and three were situational variables (FISHCAUGHT, SPECIESCAUGHT and DFBT). These variables progressed to the regression model, which explained 36.7% (Cox and Snell) or 50% (Nagelkerke) of the variance in voluntary release behaviour, and correctly classified 79.6% of cases (Table 6.5). The model demonstrated that the odds of voluntarily releasing a fish were positively related to a respondent's skill level, the number of fish caught on a trip, and the number of days spent game fishing during the same fishing season prior to the surveyed trip. Respondent's income and the number of species caught during a trip were found to be not significant. The strongest predictor of voluntary release behaviour was FISHCAUGHT with an odds ratio of 1.28 indicating that for each additional fish caught, respondents were 1.28 times more likely to release a fish voluntarily, controlling for other factors in the model. For SKILL, the odds ratio suggested that within the three point scale, an increase of one point would increase the probability of an angler voluntarily releasing a fish by approximately two and a half times. For the third significant item, respondents were about 1.3 times more likely to voluntarily release a fish for each extra day of fishing during the season prior to the surveyed trip.

Table 6.5. Results of logistic regression analysis to test for significant effects of personal and situational variables on voluntary catch and release behaviour by charter fishers

Variable	*B*	SE	Wald	*p*	Odds Ratio	95.0% C.I. for Odds Ratio	
						Lower	Upper
Constant	-6.088	1.162	27.444	0.000	0.002		
INCOME	0.160	0.088	3.312	0.069	1.173	0.988	1.394
SKILL	0.849	0.381	5.499	0.019	2.445	1.158	5.162
DFBT	0.277	0.125	4.959	0.026	1.320	1.034	1.685
SPECIESCAUGHT	0.597	0.392	2.324	0.127	1.817	0.843	3.915
FISHCAUGHT	0.248	0.060	17.083	0.000	1.282	1.139	1.442

Model $X^2(5, n=149) = 66.984, p < 0.001$
Cox and Snell $R^2 = 0.367$, Nagelkerke $R^2 = 0.500$
Concordance = 79.6%

6.4.2 Predicting voluntary release behaviour of private boat fishers

During preliminary analysis, eight of the 20 independent personal variables demonstrated a significant relationship with voluntary release behaviour:

EXPERIENCE, CLUB, KNOWLEDGE, AVIDITY, MOTC&R, CONSUMPTIVE-1, CONSUMPTIVE-4A and CONSUMPTIVE-4B. These variables progressed to the regression model, which explained 26.8% (Cox and Snell) or 36.5% (Nagelkerke) of the variance in voluntary release behaviour, and correctly classified 71.1% of cases (Table 6.6). The model demonstrated that the odds of voluntarily releasing a fish were positively related to a respondent's knowledge of game fish, avidity and their orientation to catching 'something'. However, significant differences were not observed for respondent's game fishing experience, game fishing club status, motivation to practice catch and release fishing and both item measures of attitudes to retaining fish.

Table 6.6. Results of logistic regression analysis to test for significant effects of personal variables on voluntary catch and release behaviour by private boat fishers

Variable	*B*	SE	Wald	*p*	Odds Ratio	95.0% C.I. for Odds Ratio Lower	Upper
Constant	-6.901	2.969	5.401	0.020	0.001		
EXPERIENCE	0.135	0.160	0.709	0.400	1.144	0.836	1.567
CLUB	0.279	0.635	0.194	0.660	1.322	0.381	4.589
KNOWLEDGE	1.015	0.399	6.467	0.011	2.761	1.262	6.039
AVIDITY	0.124	0.062	3.990	0.046	1.132	1.002	1.279
MOTC&R	0.012	0.280	0.002	0.967	1.012	0.584	1.751
CONSUMPTIVE-4A	0.106	0.365	0.084	0.771	1.112	0.543	2.276
CONSUMPTIVE-4B	0.011	0.347	0.001	0.976	1.011	0.512	1.996
CONSUMPTIVE-1	0.881	0.416	4.478	0.034	2.413	1.067	5.455

Model $X^2(8, n=94) = 28.093, p < 0.001$
Cox and Snell $R^2 = 0.268$, Nagelkerke $R^2 = 0.365$
Concordance = 71.1%

Seven of the ten independent situational variables demonstrated a significant relationship with voluntary release behaviour during preliminary analysis: SPECIESCAUGHT, FISHCAUGHT, FISHCAUGHTBOAT, TOURNAMENT, DFBT, FCBT, and FKBT. Correlation analysis between significant variables revealed high levels of co-linearity between some variables. Pallant (2007) warns that logistic regression is sensitive to highly correlated variables and cautions the incorporation of variables in a regression model with Pearson correlation values exceeding 0.7. Accordingly, three variables – FISHCAUGHTBOAT, DFBT, and FCBT – were excluded from

further analysis. FISHCAUGHT was highly correlated with FISHCAUGHTBOAT (r = 0.78). The latter variable was excluded as it was viewed as less integral to the theoretical framework of the study and the retention of FISHCAUGHT facilitates comparisons with charter fishers. The variables DFBT and FCBT were highly correlated with FKBT (r = 0.71 and 0.75, respectively). The decision to retain the latter was made due to a higher correlation with the dependent variable and by evaluating the relative R square values of alternative models containing only one of the three variables.

All four variables in the situational variables model were significant (Table 6.7). The model demonstrated that the odds of voluntarily releasing a fish were positively related to the number of fish caught on a fishing trip, the number of species caught on a fishing trip, the number of fish retained during the same fishing season prior to the surveyed trip and whether or not the trip was part of a fishing tournament. The model explained 20.9% (Cox and Snell) or 28.1% (Nagelkerke) of the variance in voluntary release behaviour, and correctly classified 70.9% of cases.

Table 6.7. Results of logistic regression analysis to test for significant effects of situational variables on voluntary catch and release behaviour by private boat fishers

Variable	*B*	SE	Wald	*p*	Odds Ratio	95.0% C.I. for Odds Ratio	
						Lower	Upper
Constant	-2.035	0.36	31.954	0.000	0.131		
FKBT	0.081	0.032	6.444	0.011	1.084	1.019	1.154
SPECIESCAUGHT	0.717	0.231	9.641	0.002	2.048	1.303	3.22
FISHCAUGHT	0.148	0.038	15.393	0.000	1.160	1.077	1.249
TOURNAMENT	0.842	0.311	7.304	0.007	2.320	1.260	4.272

Model $X^2(4, n=346) = 80.570, p < 0.001$
Cox and Snell $R^2 = 0.209$, Nagelkerke $R^2 = 0.281$
Concordance = 70.9%

6.4.3 Comparing fish release behaviour with the number of fish caught for individual species

The number of fish caught on fishing trips was the most significant predictor of catch and release behaviour for both fishing modes. To better understand this observation, further analysis was undertaken to determine whether this

relationship was species-specific. To do this, a continuous variable measuring fish release behaviour was constructed for individual species on trips by dividing the number of voluntarily released fish by the number of fish caught. Using correlation analysis, species-specific release rates were compared with numbers caught of the same species for each trip. This was done for each species where sufficient data were available for meaningful analyses.

For charter fishers, there was a significant positive relationship identified between the number of striped tuna caught and striped tuna voluntary release rates. A similar relationship was observed for albacore tuna among private boat fishers (Table 6.8). These relationships demonstrate that charter fishers voluntarily released a greater proportion of their striped tuna catch with increased numbers caught, while private boat fishers voluntarily released a greater proportion of albacore tuna with increased numbers caught. No other significant relationships were determined for the other two and four species examined for charter fishers and private boat fishers, respectively.

Table 6.8. Results from correlation analysis between species-specific catch and release behaviour and numbers of fish caught on individual trips

	N*	*r*	sig.
Charter Boat Fishers			
AT FRB v number of AT caught	99	0.15	0.14
ST FRB v number of ST caught	88	0.31	0.00
SBT FRB v number of SBT caught	26	0.28	0.17
Private Boat Fishers			
AT FRB v number of AT caught	266	0.28	0.00
ST FRB v number of ST caught	161	0.01	0.89
SBT FRB v number of SBT caught	44	0.06	0.73
YT FRB v number of YT caught	36	0.25	0.14
MS FRB v number of MS caught	28	0.13	0.50

FRB = fish release behaviour, SBT = southern bluefin tuna, AT = albacore tuna, YT = yellowfin tuna, MS = mako shark, ST = striped tuna

* The number of trips in which the species was caught

6.5 Discussion

The results of this study contribute to the small but growing body of catch and release research demonstrating the influence of personal and situational factors in the decision-making process of anglers. Many variables used in the

investigation have not been used in prior studies and should therefore make a valuable contribution to the literature. Of the variables found to affect catch and release behaviour in previous studies, only the number of fish caught was significant in this study. Measures of the specialisation sub-dimension 'skills and knowledge', which have not been used in previous studies, were the most effective personal predictors for both angling groups. For situational variables, positive relationships between the likelihood of voluntarily releasing a fish and both the number of fish caught on a trip and prior fishing activity during the fishing season were observed for both angling groups. For other personal and situational predictors, results were not consistent between angling groups. These differences will be discussed in light of existing research and methodological differences used to evaluate catch and release behaviour from each group. Where appropriate, a future research agenda will be recommended.

First however, it should be reminded that the following discussion should be viewed with reference to potential sampling and non-response biases among respondents from both fishing sectors, as discussed in Chapter Four. In view of this, it is possible that responses from both fishing sectors were biased toward more specialised individuals. If so, this could restrict the potential scope of the results that both measure specialisation and are significantly related to specialisation (see Chapter Four). However, this should not invalidate the results observed in this chapter: it suggests that more significant results may have been obtained if responses from less specialised fishers were proportional to their positioning within the Tasmanian game fishing population.

The predictive capacity of the models will first be discussed in light of variable types and methodological differences between angling groups to provide context for the discussion pertaining to individual variable categories. Situational variables explained a considerably greater degree of variance in fish release behaviour for both angling groups, a finding consistent with previous studies that have used situational and personal variables to understand actual catch and release behaviour (Sutton and Ditton, 2001; Hunt

et al. 2002). Of the situational variables, the number of fish caught was the most important contributor for both angling groups. The disparity between situational and personal variables was particularly evident among charter boat fishers where 'skill' was the only significant personal variable in the combined model. This result was not unexpected as the dependent variable was based on catch and release information from a single trip per respondent. Accordingly, the link between fish release behaviour and personal variables is less robust compared to a model using a dependent variable conveying information about one's fish release behaviour integrated over a period of time. Furthermore, fewer situational variables were used in the charter fisher's model than were used for private boat fishers. Therefore, if more situational variables were used, it is likely that the disparity in the predictive capacity between situation and personal variables would be greater.

In comparison, the dependent variable used for private boat fishers in the personal variables model, (which integrated information from all trips undertaken during the season), was able to detect the significance of three personal variables and explain a much greater degree of variance. This underscores the value of using a more comprehensive approach to measuring behaviour. It also suggests that some personal variables that were insignificant in the charter fisher's model may reach significance using the same methodological approach as was used for private boat fishers.

6.5.1 Specialisation related variables

Bryan (1977) suggested that as anglers become increasingly specialised, their focus shifts from fish consumption to fish preservation. As predictors of catch and release behaviour, the significance of skill for charter boat fishers and avidity and knowledge for private boat fishers accords with specialisation theory. However, making comparisons between the two angling groups is somewhat confounded by the treatment of the respective dependent variables and the use of a measure for knowledge for private boat fishers only. Nonetheless, the significance of items measuring the same specialisation sub-dimension (i.e. skills and knowledge) by both groups of anglers suggests that

it may play an important role in the decision making process of anglers to release fish.

Scott and Shafer (2001) suggested that specialisation sub-dimensions do not necessarily evolve in a lock-step manner over time, underscoring the need for a multivariate approach to encompass the complexities of specialisation. While this claim may partially explain why some specialisation related variables were not significant predictors of catch and release behaviour, other explanations are also given. Most prominently, both measures of commitment showed no discernable relationship with fish release behaviour, despite the significance of commitment related variables used by Sutton (2001) and Sutton and Ditton (2001). The current study and the two studies by Sutton used the same variable (i.e. 'importance of game fishing') to measure personal commitment. The potential ambiguities in the wording of the response categories were discussed in Chapter 4 and may contribute to the results. As the same item was used in an index by Sutton (2001) and Sutton and Ditton (2001), responses affected by perceived ambiguities may have been masked by other index items. This suggestion is supported by the reliability scores of the indices in both studies (0.68) which were below the threshold value by which Pallant (2007) considers sufficient for index use. In the current study, the non-significance of the item used to measure behavioural commitment (i.e. the value of non-trip related game fishing expenditure) as a predictor of fish release behaviour probably lies in the perceived spending patterns of game fishers on such items. As the largest expenses were for items that would not be purchased annually (i.e. rods, reels, boat modifications), the variability of values among respondents would probably not reflect individual's commitment to game fishing with a high degree of precision. In contrast, Sutton (2001) and Sutton and Ditton (2001) used the number of fishing related magazine subscriptions and organisation memberships to measure a similar construct, which was positively related to fish release behaviour.

Despite the centrality of the behavioural sub-dimension to the specialisation construct, previous studies have not observed fish release behaviour to be affected by angler's avidity or experience. Non-significant results for

experience were also obtained in the current study; however, avidity was a significant predictor of voluntary release behaviour for private boat fishers. The discrepant results for avidity between the two angling groups may reflect the more comprehensive nature of the dependent variable for the private boat model which should be more sensitive to influence from personal variables. Furthermore, the significantly greater mean and variance in avidity values among private boat fishers (see Chapter 5) provides a greater range for which significant differences may be detected.

As well as affecting angling behaviour through the specialisation process, Sutton's (2001) theoretical framework viewed experience as a surrogate measure for the level of knowledge about fishery resources and management which, through altering one's expectations, experience preferences, beliefs and attitudes, would result in the engagement of more sustainable fishing practices. To explain the ineffectiveness of experience as a behavioural predictor, Sutton (2003) suggested that the variables used were insufficient in capturing these psychological components. Nonetheless, Sutton's framework suggests that angler's fisheries-based knowledge should be more closely linked to behavioural decisions than angler's level of experience. The results pertaining to private boat fishers support this theory: both knowledge and experience were significantly correlated with fish release behaviour during preliminary analysis but only knowledge was significant in the regression model. While this result endorses the model proposed by Sutton (2001), it also raises the question as to why the variables used by Sutton (2001) and Sutton and Ditton (2003) to measure experience were unsuccessful as surrogate measures of fisheries-based knowledge. First, it could be that the 'standard' approaches used to measure experience were unsuccessful for reasons previously discussed (see Chapter Four): briefly, this approach measures the amount of time since first commencing the activity rather than the degree of involvement thereafter. Alternatively, using the number of species caught over ones lifetime, as used in this study, may be a more accurate measure of the amount of time an individual has spent fishing. Second, the predicted positive relationship between experience and fish release behaviour may ignore the recent ascension of catch and release fishing. Therefore, more

recent inductees to game fishing would have commenced fishing at a time when the catch and release ethos was more highly 'evolved'; this may be a contributing factor to the non-significant results observed for charter boat fishers.

As mentioned earlier, the survey methodology precluded the analysis of data from both sectors within the same data models: consequently, the effects of specialisation were only able to assessed within each sector, rather than across both sectors. Nonetheless, inferences may be drawn by considering both the respective differences in the relative percentages of fish released and the differences in specialisation between the two sectors, as observed in Chapter 4. Accordingly, at a sector level, a positive relationship between specialisation and fish release behaviour is observed. On the assumption of a causative link between specialisation and fish release behaviour across sectors, two interesting points of discussion arise. First, the inconclusive results pertaining to specialisation variables within each sector reinforce the "specialisation bottleneck" analogy used in Chapter 5 to describe the attainment of a boat and equipment required to fish independently. It was postulated that, whilst consistent with an expression of behavioural commitment and therefore an element embedded within the specialisation matrix, the considerable financial commitment involved in obtaining a suitable boat was also consistent with considerable changes in attitudes and behaviour – these changes were at least as pertinent as those observed according to the four item specialisation index. Therefore, sector identification is likely to be the specialisation component most consistently aligned with fish release behaviour. Second, the relative rates of fish retention between both sectors did not accord with the manner in which participants from both sectors expressed their attitudes to restrictive management measures and retaining fish (see Chapter 5). A similar discrepancy was discussed in the previous chapter in relation to the inverse relationship between the variables identified and conservation orientation. While this discussion is also relevant in interpreting the discrepancy identified in the current chapter, this issue is addressed more comprehensively in the final discussion.

6.5.2 Consumptive orientation

Sutton (2001: 84) suggested that, with the exception of attitudes to releasing fish, the other consumptive orientation dimensions "tap into attitudes that are largely unrelated to keeping or releasing fish". In light of this proposition, the weakly significant relationship between attitudes of private boat fishers to catching 'something' and fish release behaviour was not predicted. Although catching 'something' is a necessary precursor to retaining or releasing fish, its relationship with fish release behaviour was expected to be less evident than with angler's attitudes to retaining fish. However, the significance of both items measuring private boat fishers attitudes to releasing fish during preliminary analysis suggests that a latent relationship exists with catch and release behaviour, as predicted. The strength of the relationship was likely masked by variations in anglers' attitudes to retaining different fish species, as demonstrated by large variations in voluntary release rates between species. Previous studies have also demonstrated species type to influence fish release behaviour (Hunt *et al.* 2002; Sutton, 2003; Wallmo and Gentner, 2008). Conversely, angler's attitudes to catching 'something' as a means to gain satisfaction would probably not vary between species to the same degree. The findings in this study accord with Sutton's (2001) suggestion that less ambiguous results and strongest relationships between predictor variables and catch and release behaviour should occur in single species based studies.

6.5.3 Conservation orientation

Despite the perception that catch and release fishing is underpinned by a conservation ethic, none of the three variables used to measure conservation orientation were significant for either angling group. While the reasons for the results are not clear, three possible reasons are given: (1) fish released voluntarily were not done so on the basis of concern for fisheries sustainability; (2) anglers did not believe that releasing fish would make an appreciable difference to future fishing opportunities or stock sustainability; and (3) the variables used to depict conservation orientation were unsuccessful in revealing latent relationships.

In regard to the first explanation, Grambsch and Fisher (1991) and Sutton (2003) observed that some anglers released fish voluntarily on the grounds of being too small for consumption, despite being of legal size to retain. While the smallest game species caught in Tasmania are generally large enough for consumption, anecdotal evidence suggests that some fishers voluntarily release smaller fish to provide scope for retaining larger fish within their bag limit. This practice, known as 'high-grading', may distort expected results when larger fish are not subsequently caught. Anecdotal evidence also suggests that high-grading is most prevalent for SBT. The reasons for this are assumed to be their large size variation and a low bag limit compared with smaller tunas. Preferences for particular species based on their eating qualities are also likely to influence behaviour. The eating qualities of striped tuna are commonly regarded as inferior to other tunas that frequent Tasmanian waters, and fish that are retained are often done so for use as bait. Therefore, it is likely that many striped tuna were voluntarily released due to their lack of utility as a table fish, and not due to conservation concerns. The relatively high voluntary release rates for this species supports this hypothesis.

The strong theoretical link between conservation orientation and catch and release behaviour is premised on a belief that the behaviour will affect a positive conservation outcome. By adapting the theory of planned behaviour (Ajzen, 1991) to the current study, beliefs that releasing fish will make a discernable difference to the health of fish stocks and future angling opportunities will be reflected in one's behavioural intentions. However, if anglers do not believe that their behaviour can affect resource sustainability, behaviours mediated by such beliefs will not follow. Gray and Jordan (2010) observed that only 38% of avid saltwater anglers in the United States who were surveyed perceived their fishing behaviour to have an ecosystem impact. While a comparable measure was not used in the current study, the assumed understanding by fishers that game fish species are transitory, migrate internationally and are exploited in many jurisdictions may manifest beliefs that conservation efforts through releasing fish will have negligible benefits to the stock, despite well publicised conservation issues for tuna species, particularly SBT. In view of this, the assumed pivotal role of fisher's

conservation ethic in affecting fish release behaviour in the framework suggested by Sutton (2001) may need to be refined to account for fishers perceptions of whether or not their actions may have a discernable environmental impact. Furthermore, the conservation concerns of some anglers may have been suppressed by a better than average fishing season at the time of survey, particularly for SBT. This proposition is supportive of Slovic (1979) who suggests that people's perceptions of environmental impacts are generally biased by anecdotal or personal experiences, even in light of larger scale information. Anecdotally, there is also a sentiment among many Tasmanian game fishers that possession limits imposed by the State management authority are more than adequate to address conservation concerns.

While the reasons described above are likely to have influenced fish release behaviour, it is possible that the variables used were inadequate in revealing latent relationships between release behaviour and conservation orientation. Such relationships may have been masked by the voluntary release of fish that were not mediated by conservation concerns and/or by differing conservation beliefs pertaining to individual species. Again, this explanation underscores the assertion by Sutton (2001) that strongest relationships between predictor variables and catch and release behaviour should occur in studies on individual species and is furthermore consistent with Ajzen and Fishbein (1980) who suggested that a lack of specificity or congruence in the assessment of attitudinal and behavioural measures can be problematic. However, a methodological approach that distinguished participants according to species preferred, targeted or caught would present logistical problems in the collection of sufficient data within a small recreational fishery such as the Tasmanian game fishery.

Alternatively, Tarrant and Green (1999) advocated the use of a multi-faceted approach to measuring conservation orientation to better understand recreational participants. While the approach used in this study used two methodological approaches to measure conservation orientation, Newhouse (1990) identified additional variables that should be considered in future

studies. These were knowledge of conservation-related issues, locus of control (an individual's perception of their ability to create change through their behaviour) and personal responsibility (an individual's sense of obligation). This approach to conservation orientation would provide a greater understanding of whether or not fish are released due to perceptions of affecting a positive conservation outcome.

While no relationships between conservation orientation and fish release behaviour were observed for either fishing group, the results should be viewed in concert with the results for 'knowledge', discussed earlier. Together, the results suggest that a greater knowledge of issues surrounding game fish sustainability increases fish release behaviour; however, this does not appear to manifest as conservation orientation, as measured in this study. While the apparently poor link between the two measures may be explained by the reasons outlined in the preceding paragraphs, the results for 'knowledge' suggest that management efforts designed to educate anglers about potential impacts of recreational fishing may be successful in encouraging lower impact fishing behaviours such as catch and release fishing.

6.5.4 Demographic characteristics

While no demographic variables were significant in the models, income and game club status were significantly correlated with catch and release behaviour during preliminary analysis for charter boat fishers and private boat fishers, respectively. Due to the methodological differences between angling groups discussed earlier, it is likely that income may be a significant predictor of catch and release behaviour among charter boat fishers with a dependent variable measuring behaviour on more than one trip or with a greater number of respondents. If so, the relationship may reflect a need for lower income earners to offset their charter fee by bringing fish home for food. The significantly lower incomes of charter boat fishers compared to private boat fishers further supports this claim.

In light of the potential value of identifying behavioural differences through demographic variables, it is recommended that future studies incorporate a suite of potential demographic indicators. As an increasing number of fisheries require recreational fishers to purchase licences, the collection of demographic information through the purchase process will provide managers with information enabling greater efficiency in the dissemination of targeted information.

6.5.5 Catch and release attitudes

In relation to the attitude-behaviour nexus, the utility of the attitude concept lies in its ability to predict/reflect behaviour (Eiser, 1986). According to the conceptual model of catch and release behaviour proposed by Sutton (2001), attitudes relating to the behaviour of retaining or releasing fish are the immediate determinants of the behaviour. The lack of significant relationships for any of the four attitudinal variables, coupled with the significance of variables thought to influence behaviour indirectly, suggests that the variables used to measure catch and release attitudes failed to encapsulate attitudinal nuances thought to influence behaviour. Additionally, Matlock (1991) suggests that anglers commonly provide attitudinal and motivational responses to survey questions that are inconsistent with their behaviour. Nonetheless, a re-evaluation of the four variables in light of the strength of their respective predictive capacity may guide variable development for future studies.

Two of the attitudinal variables were levels of agreement with management initiatives relating to catch and release fishing while the other two were levels of importance ascribed to motivational statements with implications for the retention or release of fish. The closest relationship with catch and release behaviour was for the item "to participate in catch and release fishing" for private boat fishers, which was significant during preliminary analysis. As the dependent variable distinguished fishers who voluntarily released *any* fish on trips from those who released none, it is not surprising that it was more 'successful' than the other three variables: a higher level of importance

ascribed to releasing fish is a plausible indicator of ones intentions to release at least one fish.

Conversely, the other three variables were probably too specific, too peripheral, or too poorly aligned with the operation of the dependent variable. For example, SBTRELEASE was specific to one species only and was an unpopular proposition among fishers from both angling groups. This was also reflected in the overall percentage of SBT released, which indicated that less retention-oriented fishers probably kept one fish of their two fish bag limit rather than releasing all fish caught. For the variable MOTEAT, a stronger positive relationship with fish release behaviour would probably be evident if the dependent variable distinguished fishers based on whether or not they voluntarily released all fish. The low voluntary release rates and generous possession limits compared with prior studies of game fish (Graefe and Ditton, 1997; Sutton, 2001; Sutton and Ditton, 2001) informed the development of the dependent variable, and suggests that catching fish for consumption was similarly important for 'release oriented' and 'harvest oriented' fishers.

The results discussed in the preceding paragraph are supportive of work by Fishbein and Ajzen (1975) who suggested that the strength of the attitude-behaviour relationship is dependent on the compatibility in the level of specificity at which behaviours and attitudes are measured. To properly address this matter, an understanding of the population to be surveyed is advantageous in variable development. If researchers plan to use logistic regression to analyse results, they need to be mindful of the manner in which they plan to distinguish both levels of the binomial dependent variable, and its implications for compatibility with independent attitudinal variables. For poorly understood populations, the treatment of the dependent variable may be a post hoc decision that depends on the nature of the data collected. One way to avoid this outcome is to use a continuous dependent variable: however, the usefulness of this approach will be limited if small numbers of fish are caught and/or low possession limits apply.

Another point worthy of note for future studies concerns the classification of variables and their role within the causative framework for catch and release behaviour outlined by Sutton (2001). The framework suggests that personal variables such as specialisation-mediated factors and consumptive and conservation orientation affect behaviour indirectly by influencing beliefs, attitudes, values and behavioural norms that, in turn, influence behaviour directly. While studies, including the present study, provide general support for the model, there appears to be little or no differentiation between attitudes to catch and release and the consumptive orientation domain, 'attitudes to retaining fish'. Items pertaining to this domain measure angler's level of agreement with attitudinal statements regarding the release or retention of fish. A response to a domain item is also consistent with Ajzen's (1991) definition of an attitude as "the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question" (p. 188). As such, the framework proposed by Sutton (2001) is effectively suggesting that fisher's attitudes towards releasing fish affect fisher's attitudes toward releasing fish. Therefore, a re-evaluation of the Suttons framework may aid the interpretation of results for future studies.

6.5.6 Numbers of fish caught

For both sectors, the number of fish caught explained the largest amount of variation of all variables in the respective models. A positive relationship between fish numbers and release behaviour simply reflects the increased opportunity for anglers to release fish with higher catch numbers, and offers little insight for managers. The results are also consistent with the assumption that many fishers will retain a portion of their catch before voluntarily releasing fish within possession limits.

While the results were based on pooled data of all game species caught, additional analysis confirmed that the relationship between the *proportion* of a fish species voluntarily released and catch numbers (for that species) were not uniform between species. For charter and private boat fishers, striped tuna and albacore tuna were the only species, respectively, where higher numbers

caught corresponded to higher proportional release rates (of that species). For charter fishers, the tendency to retain a considerably higher proportion of fish overall may help explain the results. Low release rates were observed for all species highly regarded for their eating qualities suggesting that the majority of charter fishers were highly motivated to catch fish for food and were generally not inclined to release more desirable fish species prior to attaining their possession limit. However, the tendency to release striped tuna with higher numbers caught likely reflects their eating qualities; whilst edible, they are considered to be inferior to other tunas. It is therefore also likely that decisions to release striped tuna were motivated by catching other species of fish with superior eating qualities. This theory is supported by the variable 'number of species caught': the results suggest that this would make an independent and significant contribution to the model with a larger sample group. The relative abundance of striped tuna coupled with a generous bag limit of 15 fish would also provide ample scope for anglers to voluntarily release fish after retaining enough to satisfy consumptive requirements.

The positive relationship observed for albacore tuna only for private boat fishers is also likely to be a function of the relative abundance and high possession limit for this species, which is 10. Unlike charter fishers, who retained a considerably higher percentage of albacore tuna, many private boat fishers appeared to keep enough albacore to satisfy their consumptive requirements and release fish thereafter. For other species, private boat fishers appeared divided in their utilisation of caught fish: the results suggest that anglers either voluntarily released all or none. For larger species, the lower bag limits may not provide sufficient scope for consumptively oriented anglers to satisfy their consumptive requirements at a level below what they are legally allowed to retain. For striped tuna, potential explanations are less clear. However, as striped tuna are highly regarded as bait for southern rock lobster (*Jasus edwardsii*) and scalefish, it is possible that some private boat fishers retained all striped tuna caught, whilst other private boat anglers kept very few or none.

6.5.7 Prior game fishing activity during the season

On a given fishing trip, the propensity to release fish was a likelihood function of prior fishing activity within the season. For private boat game fishers, the relationship was strongest when the number of fish *kept* was used as a measure of previous activity, compared to the number of fish caught and the number of days fished. This observation is consistent with the rationale for the anticipated results, outlined earlier. When this result is viewed in context of the high percentage of trips undertaken in which fish were landed, it suggests that fishers became less inclined to keep fish if they had kept fish from previous trips in the same season. While data pertaining to fish kept or caught on previous trips were not collected for charter boat fishers, the significance of the number of days fished before the surveyed trip as a predictor variable suggests that it may be an effective proxy variable.

The results may signal an important extension to the satiation-deprivation hypothesis developed by Homans (1974) and tested among trout fishers by Finn and Loomis (2001). While the results obtained by Finn and Loomis provide support for Homans theory, they were focused on the importance placed on the relationship between catch-related motives and catch-deprivation in hypothetical fishing scenarios. Nonetheless, the results of the current study may be viewed as a reverse situation to that studied by Finn and Loomis (2001), and based on retention rather than catch related motives; that is, satiation effects were likely to progressively reduce the motivations of anglers to retain fish with each successive fish retained throughout the season.

The results have a number of implications for research on angling populations. First, it appears that the relative importance of fisher's motivations and consumptive attitudes may be a function of recent catch success or failure. While it also appears that the importance placed on retaining fish diminished throughout the season, it is assumed that the importance placed on other factors, both catch and non-catch, increases as a compensatory mechanism. This relationship could be an important area of future research with numerous implications. For example, if fisher's

motivations and consumptive attitudes are largely a function of recent activity, the value of classifying anglers according to their motivations or consumptive orientation is questionable as these factors are likely to reflect fishers attitudes to these concepts at the time of being surveyed. This claim may also explain the rather weak relationships between catch and release behaviour and both consumptive orientation and catch and release attitudes in this study.

Second, the importance of satiation-deprivation effects on fish retention is likely to be greater for fisheries with limited season length, such as the Tasmanian game fishery. Finn and Loomis (2001) observed that deprivation effects on catch motivations increased with the amount of time between fishing trips. As peak activity for the Tasmanian game fishery is usually from March to May, fishers on their first trip of the season would not have participated in game fishing for many months, amplifying the perceived importance of retaining fish. The observation of disproportionately high rates of angling participation at the start of limited length recreational fishing seasons for many fisheries (i.e. Lyle *et al.* 2005; Sharp *et al.* 2005) suggests that *overall* motivations to participate are a function of deprivation: it is therefore plausible to suggest that retention-based motivations are consistent with this.

Furthermore, the results have implications for the interpretation of results for avidity, which was discussed earlier. The significance of avidity as a predictor of fish release behaviour was hypothesised to be a function of angler specialisation. However, the observation that fish release behaviour is partly a function of prior activity suggests that more avid fishers may tend to release fish, particularly later in the season, due to retention-satiation effects. The non-significance of avidity for charter boat fishers may be explained by their lower rates of participation which would provide less scope for such effects to be realised. While the relative contributions of specialisation and retention-satiation (and possibly other factors) cannot be conclusively addressed, the interactive effects of both variables of catch and release behaviour has direct management implications and could be a subject of further research.

6.5.8 Tournament participation

As predicted, private boat anglers participating in tournaments or club affiliated events were more likely to voluntarily release fish on trips. This result is consistent with prior research suggesting that, while tournament fishers are generally more motivated than non-tournament anglers by catch-related factors, they are generally less motivated to retain fish (Ditton and Loomis, 1985; Loomis and Ditton, 1987; Falk *et al.* 1989; Ditton and Fisher, 1990; Antia *et al.* 2002; Oh *et al.* 2007). The results are also intuitive in light of the rules and guidelines of the majority of game fishing tournaments in Tasmania (those endorsed by the TGFA) that award tournament points for tag and release fishing (in addition to retained fish).

Future studies may consider comparing catch and release behaviour on tournament trips with catch and release behaviour by the same anglers on non-tournament trips and/or with non-tournament anglers in general. While motivations and consumptive attitudes by tournament fishers are well understood, surveys are generally undertaken within the context of tournament participation, where catch and release principles are increasingly being promoted, and/or enforced. If studies determine that the catch and release ethos promoted through clubs, associations or tournaments encourages fish release behaviour on *non*-tournament trips (or trips unaffiliated with clubs or associations), an impetus for greater collaboration with management agencies may be provided. The pertinence of this suggestion is strengthened by studies demonstrating significantly greater levels of participation among 'tournament fishers' compared to non-tournament fishers (Loomis and Ditton, 1987; Falk *et al.* 1989).

6.5.9 Conclusions

The results of this study sustain the overarching hypothesis that catch and release decisions are a function of both personal and situational factors and provide general support for the framework proposed by Sutton (2001). The identification of significant factors untested in previous studies suggests that fish release behaviour is not fully understood and ample scope remains for

future studies in this area. Furthermore, differences observed between the two angling populations in this study coupled with inconsistencies with prior studies suggests that, like other dimensions of research on angling populations, results from individual studies may have limited applicability to the wider angling population. However, it is plausible that the results of this study will have greatest relevance for recreational fisheries defined by an array of target species and a catch and release ethic that is not firmly entrenched.

Whilst offering general support for Sutton's (2001) framework on understanding catch and release behaviour, the current study also identified three main areas that require consideration in future re-conceptualisations of the framework. First, the model is underpinned by the assumption that fish released are done so, at least in part, by conservation concerns. While this assumption may be applicable for fisheries where the conservation-related catch and release ethic is well established, the framework will likely have less relevance to other fisheries. Second, the framework assumes that a fisher's consumptive orientation will affect fisher's attitudes to releasing fish, which will in turn influence behaviour. This effectively suggests that a fisher's consumptive orientation is distinct from his or her attitudes to releasing fish, which it is not – particularly the consumptive orientation domain pertaining to releasing fish. Third, the highly significant nature of different measures of prior fishing activity suggests that satiation/deprivation effects need to be considered in further re-conceptualisations of the framework to properly understand angler's willingness to release fish.

While implications for further research relating to individual variable categories have been comprehensively addressed in the relevant discussion sections, three general suggestions for future research are outlined. First, the study did not address the impacts of fish size or angler's preferred species. The importance of these predictors has been demonstrated in previous studies (Hunt *et al.* 2002; Sutton, 2003; Lyle *et al.* 2009). The variety of species caught in the present study, differences in species possession limits, and inter-

specific variability in release rates are likely to be important factors influencing anglers overall release behaviour.

Second, the comparative results between the two angling populations demonstrate the value of using a comprehensive dependent variable to measure catch and release behaviour. As individual anglers are unlikely to demonstrate identical fish release behaviour on successive trips, a dependent variable reflecting one's behaviour on more than one trip will yield more reliable results and facilitate a better understanding of the effect of personal factors. This point further underscores the effectiveness of the telephone/diary survey as a means to collect detailed catch information on successive trips where recall bias is minimised. Compared to other survey methods, this methodology should be particularly effective for small study populations where it may be difficult to survey sufficient numbers of respondents to derive robust data based on their most recent angling trip.

Third, further researchers should consider the use of continuous dependent variables to measure catch and release behaviour. While the effectiveness of this approach will be minimised through low catch numbers and/or low possession limits, it has the potential for a more nuanced understanding of catch and release behaviour. With the exception of work by Hunt *et al.* (2002), studies have used dependent variables based on whether all fish caught were voluntarily released, retained, or whether some fish were released. As many fishers are likely to retain a portion of their catch, much of the variance in behaviour is likely to reside in the relative proportions of released to retained fish. According to Sutton (2001), anglers of this description are likely to be more numerous in fisheries where the catch and release ethic is less firmly established. As this observation by Sutton (2001) was made in reference to United States billfish anglers, for whom the catch and release ethic is well understood to be firmly entrenched, it is likely that the value of using a continuous dependent variable to assess catch and release behaviour will result in a better understanding of fishers from the overwhelming majority of fisheries. While individual catch and release decisions are the cornerstone of Sutton's (2001) framework by representing

the main unit of analysis, a continuous dependent variable is essentially a composite average value of a series of catch and release decisions. Accordingly, the framework would remain valid for this type of analysis.

CHAPTER 7

Assessing the influence of angler specialisation and catch and release behaviour and attitudes on willingness to pay

7.1 Introduction

The use of non-market valuation techniques to value recreational fisheries has increased in recent decades. Many studies have been motivated by the need for reliable estimates of the value of resource use by recreational fishers to guide allocation decisions in light of competing uses. However, non-market valuation studies may also be used to estimate the value of an anticipated change in fishing quality (for example, through artificial stocking), and to assess heterogeneity among individuals (or sites). Understanding the economic values ascribed by different sub-populations within a recreational fishery may inform policies that seek to maximise value. In this study, an iterative bidding contingent valuation (hereafter referred to as CV) methodology was used to determine whether resource valuation ascribed by Tasmanian game fishers was influenced by (i) specific sub-dimensions of recreational specialisation and (ii) harvest orientation.

Since its original development by Bryan (1977; 1979), the concept of recreational specialisation has provided a framework to better understand recreational fishers. While early studies focused on further development of the concept, later studies had more specific management implications. Recently, Oh *et al.* (2005) and Oh and Ditton (2008) demonstrated that more specialised fishers were willing to pay more to fish per trip than less specialised fishers. In both studies, willingness to pay (WTP) was assumed to be closely aligned with one of the three specialisation sub-dimensions – commitment. Oh *et al.* (2005) argued that more committed participants have greater financial and emotional investment in the activity and therefore have more to lose if participation is discontinued. The potential application of the results was explained in reference to a well established relationship between

specialisation and resource conservation (Bryan, 1977; Buchanan, 1985; Ditton *et al.* 1992); here, Oh *et al.* (2005) suggested that management actions promoting resource sustainability and conservation are likely to have greater support among more specialised fishers (with expressions of high economic value) than among less specialised fishers.

Whilst the studies by Oh *et al.* (2005) and Oh and Ditton (2008) advanced the understanding of the relationship between WTP and specialisation, results were based on specialisation indices. Therefore, it was not possible to determine the relative importance of specialisation sub-dimensions such as behaviour, skills and knowledge and commitment in predicting consumer surplus. Due to this limitation, Oh *et al.* (2005: 274) suggested that "future research needs to address the relationships between participant valuations and specific sub-dimensions of recreational specialisation". In this study, two measures of behaviour, two measures of knowledge and skills and three measures of commitment were used to assess the relationship.

Many studies have identified differences within fishing populations in regard to anglers' orientation to retaining or releasing fish. Some studies have demonstrated this through data on actual fishing behaviour while others have inferred this tendency through fisher's attitudes to specific management proposals, motivations pertaining to fish retention and agreement with attitudinal statements depicting consumptive orientation. Understanding the way in which fisher's orientation to catch and release affects consumer surplus has received little attention from researchers but has important management implications. Most importantly, releasing fish may be seen as a more efficient use of resources as released fish may provide valuable fishing experiences for successive anglers who may, in turn, choose to harvest or release the same fish (Milon, 1991). If the value of the fishing experience by catching and releasing a fish is not significantly less than the value associated with retaining a fish, claims of greater economic efficiency through releasing fish are valid. Such claims are, however underpinned by the assumption that released fish have a realistic chance of being caught again.

The few relevant studies available on the subject (e.g. Sutton, 2001; Schuhmann and Schwabe, 2004) suggest that fishers who release all fish caught are willing to pay more per trip than fishers who don't release all of their catch. When viewed from a perspective of recreational specialisation, the results are plausible as other studies have demonstrated a higher WTP to fish among more specialised fishers (Oh *et al.* 2005; Oh and Ditton, 2008), who are recognised as being more likely to engage in responsible fishing practices than less specialised fishers (Bryan, 1979). While the approach undertaken by Sutton (2001) and Schuhmann and Schwabe (2004) distinguished between fishers who released all fish caught from fishers who retained at least one fish, the current study distinguished between "less harvest oriented" fishers and "more harvest oriented" fishers based on a roughly equal division of the study population. This distinction was deemed necessary due to the nature of the fishery which is characterised by a relatively high rate of fish retention.

In relation to the attitude-behaviour nexus, the utility of the attitude concept lies in its ability to predict behaviour (Eiser, 1986). Therefore, if consistent with angler behaviour, attitudinal data on fish release and retention may be useful to managers as collecting attitudinal data are logistically less problematic than collecting data on fish release behaviour over successive trips. In a general sense, studies that have compared behavioural intentions with actual behaviour have reported mixed results (Adamowitz *et al.* 1994; Heshner *et al.* 1994; Haener *et al.* 2001; Wallmo and Gentner, 2008). In Chapter 6, the relationship between fish release behaviour and attitudes to it were assessed using four variables. To maximise the chances of yielding results that may be useful to managers, the two attitudinal variables with the closest relationship with fish release behaviour were chosen as variables in this chapter. One was a measure of the importance of catch and release fishing as a motivational factor and the other was a measure of agreement with the promotion of catch and release fishing.

Data were collected using an iterative bidding valuation technique. The method was chosen due to the low number of respondents. While dichotomous choice formats are generally considered preferable to stated

preference formats, the United States National Oceans and Atmospheric Administration (NOAA) suggests a minimum sample size of 1000 for this method (Arrow *et al.* 1993). This requirement is a reflection of the fact that the qualitative (yes/no) responses elicited through a dichotomous choice survey convey far less information than quantitative point estimate values obtained through iterative bidding (and open-ended) formats. Nonetheless, other authors using quantitative CV methods with relatively small sample sizes suggest that robust and reliable results may be attained through well designed and executed qualitative CV surveys (Baker and Pierce, 1997; Arlinghaus and Mehner, 2004).

7.1.1 Objectives

The first objective of this study was to assess the predictive capacity of variables measuring sub-dimensions of specialisation on the annual consumer surplus of private boat game fishers. The second objective was to assess the predictive capacity of both anglers' attitudes to fish harvesting behaviour and actual fish harvesting behaviour on annual consumer surplus.

7.2 Methods

7.2.1 Sample

Ninety-nine Tasmanian private boat game anglers responded to an iterative bidding contingent valuation survey administered during a telephone interview at the end of the 2007 game fishing season. The telephone interview was designed as an end of season 'supplementary survey' of fishers who participated in a telephone/diary survey of their fishing trip details over the course of the 2007 season. Furthermore, the same respondents also completed a socio-economic mail questionnaire about their involvement in the Tasmanian game fishery during 2006. Data used for this study were collected from all three surveys. Descriptive statistics for the variables collected in each survey are shown in Table 7.1. For more information on how each of these three surveys was conducted, see Chapter 3.

Table 7.1. Summary statistics of independent variables

Variable**	Type of Data	Mean/Median*	SD	Source
MOTCR	Nominal	3.0	1.2	Mail Questionnaire
CRPROMOTE	Nominal	3.6	1.1	Mail Questionnaire
CRBEHAVIOUR	Ordinal			Telephone/Diary Survey
AVIDITY	Continuous	7.4	6.1	Telephone/Diary Survey
NTCOSTS	Continuous	$2,920	$4,163	Telephone/Diary Survey
CLUB	Ordinal			Mail Questionnaire
KNOWLEDGE	Nominal	3	0.9	Supplementary Interview
ABILITY	Nominal	2	0.6	Mail Questionnaire
IMPORTANCE	Nominal	1	0.9	Mail Questionnaire
SPECIESNUMBER	Continuous	4.0	1.7	Mail Questionnaire
AGE	Continuous	45.5	8.1	Mail Questionnaire
INCOME	Nominal	6	2.6	Mail Questionnaire
FISHCAUGHT	Continuous	20.6	27.7	Telephone/Diary Survey

* Mean values were used for continuous variables, median values were used for nominal values
** See text in the following section for expanded definitions of variables

7.2.2 The CV Instrument

The iterative bidding CV question was designed to elicit participant's willingness to pay over and above what they had already paid to go game fishing during the 2007 season. The instrument was pre-tested among eight people who were unfamiliar with contingent valuation methodologies. This process prompted changes to the wording and structure of the question format.

Prior to the elicitation of willingness to pay in the supplementary survey, respondents were read a statement designed to minimise objections to the nature of the CV question:

> *We ask this next question so we can better understand the value of the game fishery to anglers. This type of question gives us an insight into angler's attitudes towards game fishing and the importance that Tasmanian game fishers put on their sport. Game fishing may be worth more to anglers than what they pay to do it and you will soon be asked to put a dollar figure on the value that you place on game fishing. When I ask you, please consider your answer carefully and within the confines of your income.*

As consumer surplus represents WTP above what has already been spent, determining respondent's expenditure is a necessary precursor when determining consumer surplus. Accordingly, the interviewer presented each respondent with their total attributed trip-related game fishing expenses made throughout the 2007 season (from data collected through the telephone/diary survey) prior to asking respondents for their WTP above what they had already spent.[51]

> *Based on the information you have given us during this survey, your trip expenses for this season were approximately $<____>. Now, imagine that your trip expenses increased to the point where it cost you an extra $500 a season to go game fishing as often as you did this season. Think about the benefits you gain from game fishing, and keep in mind your level of income and other financial responsibilities. Would you be prepared to pay the extra $500 in fishing related expenses to go game fishing as often as you did this season?*

If the respondent was willing to pay $500[52] (i.e. the first bid value), s/he was asked whether they were willing to pay the next bid value , $1000. If so, the iterative process was repeated at $1000 intervals until either the respondent said "no" or until the final bid of $5000 was reached. If the respondent was not willing to pay the initial bid of $500, the iterative process progressed downwards using the following bid amounts: $250, $150, $75, $40, and $0. In both cases, the highest positive bid value accepted was taken as the respondents WTP. If a respondent nominated $0 as their final bid value, they

[51] The process by which expense data was collected and game fishing attribution was applied was designed to impart the accurate collection of expense data and minimise recall bias. See Chapter Two for more information.

[52] The starting point and bid range were informed by responses to an open-ended CV question used in the 2006 mail questionnaire for private boat fishers (see Chapter 2). This was consistent with the approach of Boyle and Bishop (1988) and Bateman *et al.* (1995) that, in the absence of *a priori* expectations of WTP, used an open-ended pilot question to inform bid levels for ensuing dichotomous choice CV surveys. For the open-ended question in the 2006 mail questionnaire, the mean value of $527 and highest WTP value of $5000 (after truncating the data to remove three outliers) were used to inform the initial and highest bid values, respectively in the iterative bidding process.

were asked further questions to determine whether the bid was a true reflection of their WTP or was due to personal objections to the nature of the question.[53]

On average, fishers expressed a willingness to pay an extra $1711 per year to fish as often as they did during the 2007 season; an average consumer surplus of $231 per day fished. This was in addition to an average expenditure of $1262 on game fishing attributed trip costs for the 2007 season. Expenses equated to an average of $170 per day fished. The bulk of angler's reported expenses were for boat fuel, vehicle fuel, food and beverages, accommodation and competition fees. Mean consumer surplus, as a percentage of trip costs, was 135.6%. See Figure 7.1 for the distribution of WTP responses.

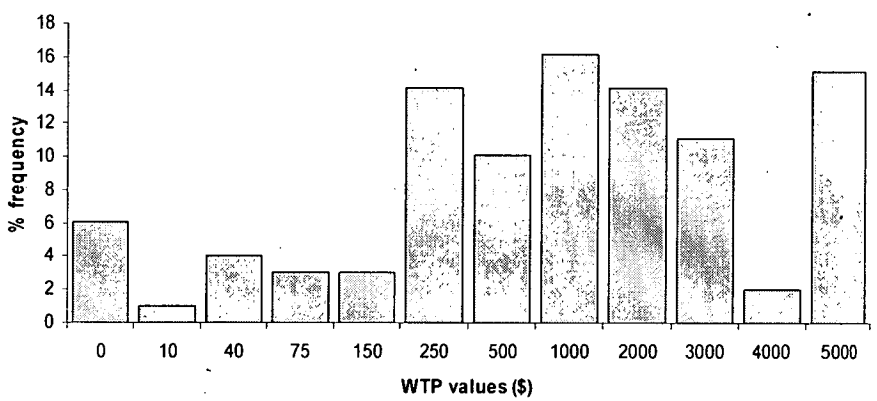


Figure 7.2. Distribution of WTP responses

7.2.3 Data analysis

Three multiple regression linear models were developed to determine if fisher's WTP for game fishing in Tasmania was affected by variables measuring specific sub-dimensions of specialisation, and variables measuring behaviour and attitudes relating to fish retention. Analyses were performed

[53] Of the 99 respondents who were asked the WTP question, 93 demonstrated a willingness to pay more than the trip costs already incurred to fish as often as they did during the 2007 season. Of the six people who were not prepared to pay more, further questioning determined that they were either unable or unwilling to pay more, and not because they objected to the question. Therefore, all six responses of "$0" were considered to be valid point estimates and were used for analysis.

using SPSS 16.0 statistical software. Thirteen independent variables were used, and are described below. Descriptive statistics for independent variables are presented in Table 1.

Specialisation variables

In total, seven variables were used to represent the three specialisation sub-dimensions, as described by Scott and Shafer (2001). AVIDITY, calculated as the number of days spent game fishing over the 2007 season was used as a measure of the sub-dimension *Behaviour*. SPECIESNUMBER was used as a proxy for experience by summing the number of game species caught in Tasmanian waters during fisher's lifetimes. For the sub-dimension *Knowledge and Skills*, two variables were used: KNOWLEDGE and SKILLS were self assessed measures of fisher's knowledge of game fish biology and sustainability, and game fishing abilities relative to other game fishers, respectively. The former was measured on a four point scale while the latter was measured on a three point scale.

Consistent with the view of Buchanan (1985) that the concept of *Commitment* entails both a behavioural and psychological dimension, NTCOSTS and CLUB were used to measure the former and IMPORTANCE was used to measure the latter. NTCOSTS was the total annual non-trip costs attributed to game fishing[54]. CLUB was a binary variable depicting whether or not respondents were affiliated with a game fishing club or association. IMPORTANCE was a measure of the perceived importance of game fishing relative to other recreational activities on a three point scale.

Catch and release variables

CRBEHAVIOUR, was a binary variable based on participant's catch and release behaviour during the 2007 game fishing season. Respondent's were divided into two roughly equal groups representing fishers who voluntarily released a lower (Group 0) or higher (Group 1) proportion of their catch[55].

[54] See Chapter 2 for details of the attribution procedure.
[55] The same variable was used in Chapter Five as a dependent variable for private boat fishers – see this chapter for details about how this variable was developed.

Two variables measured anglers' attitudes to catch and release fishing. The first variable, MOTCR, was a measure of the importance of the motivational item "to participate in catch and release fishing" on a five point Likert-type scale. The second variable, CRPROMOTE, was a measure of agreement with promoting catch and release fishing, also expressed on a five point scale.

Other variables

Two demographic variables were used to improve the understanding of factors affecting WTP. AGE was used as a continuous variable while INCOME was reported in $10,000 categories; from less than $20,000 per annum (personal income) to greater than $100,000 p/a. The use of INCOME as a variable also enabled the income elasticity of WTP to be assessed, as a greater WTP could reasonably be expected with a greater capacity to pay. The number of fish caught throughout the 2007 season (TOTALCAUGHT) was also included as an explanatory variable to assess the sensitivity of WTP estimates to scope of the 'good' offered. While scoping bias, or 'embedding', was also addressed by the inclusion of AVIDITY, the use of both variables enabled the relative importance of each variable to be determined in the model.

7.3 Results

All three models demonstrated the significant influence of AVIDITY, INCOME and TOTALCAUGHT on angler's WTP (Table 7.2). Also significant in Model 1 was the catch and release attitudinal variable, CRPROMOTE. However, the other catch and release attitudinal variable, MOTCR was insignificant in Model 2, as was catch and release behaviour in Model 3.

Consistent with economic theory, respondent's personal income had the most significant effect on WTP. On average, WTP increased by $174-183 when income increased by $10,000. While all specialisation variables demonstrated coefficients in the expected direction, only AVIDITY was found to have a significant effect on WTP. The results suggest that respondents were willing

to pay between $65 and $72 for each successive day fished. The significance of AVIDITY is intuitive given that fishers were willing to incur higher costs when 'offered' a greater level of access to the fishery. The demonstrated influence of avidity on WTP further demonstrates that bid values were responsive to scope, an issue confounding many CV studies (Carson, 2000).

The significant influence of TOTALCAUGHT on WTP suggests that the number of fish caught during the 2007 season made a contribution to the models independent from the influence of AVIDITY. In other words, the number of fish caught was not simply a function of how many days respondents had spent fishing. Here, anglers expressed a willingness to pay an extra $16 to $18 for each additional fish caught over the course of the fishing season.

The significance of CRPROMOTE suggests that fishers who were more receptive to the promotion of catch and release fishing were willing to pay higher annual costs. While demonstrating a positive coefficient, as predicted, catch and release fishing as a motivational factor did not have a significant influence on WTP. Also insignificant was CRBEHAVIOUR, indicating that fishers who voluntarily released more fish were not willing to pay more to fish for game species in Tasmania.

Table 7.2. Results of multiple linear regression of several independent variables on Tasmanian private boat angler's willingness to pay (WTP; dependent variable)

Variable	Model 1	Model 2	Model 3
(Constant)	-630.807	48.827	509.507
	(1078.164)	(1040.387)	(953.739)
NTCOSTS	0.018	0.015	0.026
	(0.036)	(0.038)	(0.036)
AVIDITY	65.422**	70.068**	72.435**
	(32.086)	(32.111)	(32.500)
AGE	-10.573	-14.135	-15.226
	(18.029)	(17.989)	(18.141)
INCOME	175.184***	183.047***	174.179***
	(57.946)	(59.267)	(58.904)
TOTALCAUGHT	16.199**	16.147**	18.019**
	(6.868)	(6.950)	(7.138)
CRPROMOTE	245.918*		
	(132.845)		
MOTCR		102.651	
		(129.407)	
CRBEHAVIOUR			-236.913
			(314.196)
R^2	0.421	0.402	0.402
Adjusted R^2	0.380	0.361	0.359
ANOVA	0.000	0.000	0.000
F	10.301	9.747	9.510

* = $p < 0.10$, ** = $p < 0.05$, *** = $p < 0.01$

7.4 Discussion

The results demonstrate that angler's willingness to pay above what they had already spent to go game fishing was significantly influenced by four variables used in this study – avidity, income, the number of fish caught during the season and fishers level of agreement with promoting catch and release fishing. The significance of the first three variables demonstrates consistency with economic theory. In other words, WTP would be expected to increase according to fisher's economic capacity to pay more, and with an increase in the quantity of the 'good' offered. With respect to the hypotheses regarding specialisation and fish retention, the results are less conclusive, and are discussed below.

7.4.1 Specialisation

The results suggest that of the seven specialisation-related variables used in this study, only avidity made a significant and unique contribution to the model. Whilst significant in terms of WTP per year, and therefore sensitive to scope, avidity was not significant when assessed in terms of WTP per trip. However, the observation of coefficients with expected signs for all seven variables suggests slight specialisation-mediated effects on WTP that may be discernable at a significant level using a larger sample size. As mentioned in previous chapters, the reasonable likelihood of sampling and non-response bias effects may have biased the sample group toward more specialised fishers. If so, the relationships between WTP and specialisation related variables in this study may be understated as lesser specialised fishers may not have been adequately represented.

Oh *et al.* (2005) suggested that commitment was the specialisation sub-dimension that would be most likely to result in a greater WTP by more specialised fishers. The lack of significance for all three commitment-related variables in this study may suggest that the variables used were unsuccessful in detecting latent relationships. For IMPORTANCE, potential ambiguities in the wording of the item response categories were discussed in Chapter 4 and may have contributed to the insignificant results. The non-significance of NTCOSTS may lie in the spending patterns of game fishers on non-trip related items. As the largest expenses were for durable items that would not be purchased annually (i.e. rods, reels, boat modifications), the variability in values among respondents would probably not reflect individual's commitment to game fishing with a high degree of precision. Alternatively, future studies may consider using the value of respondents fishing gear as a measure of behavioural commitment. A variable of this nature is more closely aligned with the description of commitment by Scott and Shafer (2001) as the degree of personal and behavioural investment that recreationists accrue over time. This description entails an accumulation of committed behaviours (i.e. purchases of related equipment) over the course of one's angling career.

Whilst the variable CRPROMOTE was used in this study as a measure of fisher's attitudes to releasing fish (and will be discussed accordingly later in this section), an alternative interpretation views the variable as an expression of commitment. In support of this, Scott and Shafer (2001: 329) suggest that "personal commitment is likely to be expressed by engaging in behaviours that promote the interests of the activity". Actively promoting catch and release fishing is consistent with this description. Despite the non-significance of the three variables used to measure commitment, the results for CRPROMOTE may indicate support for the supposition by Oh *et al.* (2005) that commitment is the specialisation sub-dimension most likely to affect WTP values.

7.4.2 Catch and release attitudes and behaviour

Viewed collectively, the results observed for the three catch and release variables are difficult to interpret. Clearly, the hypothesis relating to behaviour was rejected, as was the hypothesis relating to catch and release fishing as a motivational factor. However, the significant predictive capacity of CRPROMOTE on WTP suggests that it may have measured angler's harvest orientation in a manner not successfully captured by the behavioural variable, despite the intuitive expectation of a stronger relationship between WTP and behaviour. The original hypothesis, however, was based on two studies on single species fisheries (Sutton, 2001; Schuhmann and Schwabe, 2004). It is plausible that the capture of seven different game species in the current study masked a latent relationship between WTP and fish release behaviour through two mechanisms; (1) by affecting fish release/retention behaviour of anglers and, (2) by affecting anglers WTP estimates. Of the former, the large variation in species-based release rates observed in Chapter 6 is consistent with other studies that have observed angler's fish release behaviour to be impacted differently by different species (Hunt *et al.* 2002; Sutton, 2003; Lyle *et al.* 2009). Due to these effects, Sutton (2001) suggested that the strongest relationships between catch and release behaviour and other variables should occur in single species based studies. Of the latter mechanism, Wheeler and Damania (2001) demonstrated that the recreational

value of a species depended on its eating and sporting qualities, scarcity and size: the seven species caught during the study period varied markedly with respect to these qualities.

Variability in fish retention rates and activity valuation imposed by a variety of fish species may also explain the predictive significance of CRPROMOTE, but not CRBEHAVIOUR. Catch and release attitudinal data pertained to Tasmanian game fishing in *general* and was therefore unaffected by situational factors such as species type caught on specific trips. However, the same rationale does not explain the non-significance of MOTCR as a predictor of WTP. While the two attitudinal variables appear to be measuring a similar construct, fishers may not consider the opportunity to release fish as an important motivator to go fishing, despite endorsing the practice and/or understanding its perceived conservation benefits. In other words, anglers with a tendency to release fish may be motivated to go fishing by factors (both catch and non-catch) unrelated to retaining fish, but their tendency to release fish may be more closely related to their lack of motivation to retain fish rather than as a motivation to release fish.

Meanwhile, an expression of support for the promotion of catch and release fishing is an expression of support for conservation related behaviour, which Oh and Ditton (2008) suggest, should be consistent with higher WTP values. If this attitudinal support for catch and release fishing corresponds with behaviour, a more efficient use of fisheries resources may follow as released fish may provide valuable fishing experiences for successive anglers who may, in turn, choose to harvest or release the same fish (Milon, 1991). The results for CRPROMOTE are encouraging and warrant further research into this area. Clearly, however, research should heed the difficulties imposed by assessing anglers WTP in a multiple species fishery, especially in relation to catch and release behaviour. Studies attempting to determine the most efficient use of fisheries resources by comparing the values ascribed to fishery access by fishers with different harvest orientations should focus on individual species for which this information is most valuable. In relation to the Tasmanian game fishery, well publicised concerns over the plight of SBT

stocks in recent years make this species an obvious candidate. If determining the most efficient use of fisheries resources is the primary objective of a contingent valuation study, research should focus on ascertaining marginal WTP for fish caught and fish kept (Wheeler and Damania, 2001). Nonetheless, it needs to be considered that any study of this nature is underpinned by the assumption that released fish have a realistic chance of recapture before concluding that releasing fish will lead to a more economically efficient outcome for the fishery. Due to the paucity of research on post-release survival and fitness of large pelagic fish, research of this nature is required on Tasmanian game species in order to address this assumption.

7.4.3 Methodological implications

While the results pertaining to both specialisation and catch and release attitudes have potentially valuable implications for further research, the overall methodology employed in this study may also be of interest to future contingent valuation researchers. As outlined earlier, other studies that have used quantitative CV methods with relatively small sample sizes (i.e. Baker and Pierce, 1997; Arlinghaus and Mehner, 2004) provide evidence that robust and reliable results may be attained through well designed and executed qualitative CV surveys, despite a growing preference for dichotomous choice methodologies as advised by the NOAA (Arrow *et al.* 1993). In justifying its preference for dichotomous choice formats, the NOAA suggested they more closely resemble 'regular' markets where people purchase, or decline to purchase, goods at a posted price. The NOAA also concluded that open-ended and iterative bidding surveys are particularly susceptible to starting point and strategic biases. Accordingly, the ability of open-ended and iterative bidding techniques to yield valid and robust results was questioned. However, the results of this study conform to measures of reliability and construct validity, as suggested by Mitchell and Carson (1989). Mitchell and Carson suggest that reliability can be measured by obtaining an r^2 value greater that 0.15 when WTP is regressed against a set of independent variables. The r^2 values of between 0.402 and 0.421 obtained in this study clearly exceed this threshold

value. (These values are also considerably higher than the r^2 value of 0.154 obtained by Arlinghaus and Mehner [2004], who demonstrated the reliability of using an open-ended CV instrument to measure the use value of recreational carp fishing). In relation to construct validity (i.e. the degree that WTP measures the theoretical construct under investigation), Mitchell and Carson (1989) suggest the need for significant relationships among independent variables that, according to economic theory, should be correlated with WTP. The significance of avidity, income and the number of fish caught in the current study provides evidence for this. As the qualitative (yes/no) dichotomous choice format requires a large number of respondents (>1000), the results in this study suggest that the iterative bidding technique may be a valuable tool for use in small study populations where it may unfeasible to attract a large number of respondents.

CHAPTER 8

General Discussion

8.1 Implications of the findings for human dimensions of fisheries research

In this section, the results of the current study will be discussed in relation to how they have addressed the primary objective of this study. In other words, the discussion will entail the study's contribution in critically evaluating the validity of established and emergent concepts and frameworks underpinning socio-economic research on recreational fishing populations. While specific contributions have already been addressed in relevant chapters, the following will focus on those perceived to be most significant, and/or relevant. Overarching issues relating to the methodologies used will also be discussed and further research needs will also be identified. While the potential effects of sampling bias and non-response bias have been discussed in Section 1.4 and in each of the data chapters, the reader is urged to view the following section in light of these implications.

In broad terms, this study adds weight to the apparently growing consensus that angling populations are unique, and that caution needs to be exercised before extending generalisations between fisheries. While many of the results in this investigation were supportive of theoretical and empirical consensus, sufficient inconsistencies were encountered to conclude that the Tasmanian game fishery is characterised by 'unique' elements. In general terms, the limited degree of compatibility between angler based studies can be partially attributed to differences in the ways in which various concepts are classified and measured; however, a substantial component of the variability must be attributed to fundamental differences between fisheries. Accordingly, there appears to be a limited number of predictive elements characterising fishers' relationships with fishing from fishery to fishery, despite the existence of theoretical constructs and frameworks in which to understand the attitudes and behaviours of fishers. Therefore, for a fishery to be managed in a manner that

optimises social value among fishers, whilst adhering to responsible fishing practices, it is necessary to understand the nuances and complexities unique to individual angling populations. Consistent with this, the current study population demonstrated numerous dissimilarities with expected results based on previous studies. While these dissimilarities have been comprehensively discussed, findings seen as most pertinent to the established literature will be discussed further.

In Chapter Four, the interpretation of results precipitated the overall conclusion that the current state of knowledge of recreational specialisation, as it applies to fishers, is constrained by a lack of contextual development. If developed, a contextual framework would afford a more robust, albeit more flexible frame of reference in which to understand fishers and interpret results that do not accord with the current state of knowledge. Numerous results of this description were identified in the current study – on close inspection of comparable studies, similarly 'discrepant' results were also observed, despite questionable survey designs and analytical approaches undertaken that suggest otherwise.

It was argued that the development of contextual models would help explain some of the results observed. While the recreational specialisation model would benefit from contextual reinterpretations based on social, cultural, economic and managerial input, the results obtained in this study likely provide evidence for contextual development provided by the idiosyncratic nature afforded by different target species. In explaining this position, it was argued that as the recreational specialisation concept was developed with reference to trout fishers, many of the fundamental relationships underpinning the concept may not be applicable to other fishing populations. It was also argued that different degrees of behavioural scope (i.e. fishing techniques and settings) afforded by different ways in which different species may be targeted in turn affected the degree to which specialisation may be demonstrated and identified. In essence, this interpretation suggests that the length of the 'specialisation continuum' (Bryan, 1977; 1979) will depend, at least in part, on the species targeted.

Results that were different from those predicted from specialisation theory included those relating to restrictive management options, consumptive orientation, and the assumed progression from catch to non-catch fishing motivations with specialisation. These three fundamental components of the current state of knowledge of specialisation are inter-related by the assumption that as fishers become more specialised, their focus shifts from catching and harvesting fish to minimising their impact on fish populations and developing a greater affinity with aspects of the fishing experience that are separate from catching and harvesting fish. In explaining the results, it was argued that unlike trout fishers, for whom the recreational specialisation concept was developed, Tasmanian game fishers are likely to have a very different relationship with their target species. Perhaps most importantly, the cause and effect relationship between exploitation and population level effects are less palpable in fisheries entailing a commercial fishing sector i.e. fishers may acknowledge that they are not wholly (or largely) responsible for resource exploitation within a fishery. In contrast to most trout fisheries, the presence of game species in Tasmanian waters is an ephemeral phenomenon, and most fishers are likely to be mindful that fish are exploited by both recreational and commercial fishers in jurisdictions outside Tasmanian waters. This understanding by fishers is further likely to limit attitudes of responsibility and custodianship toward the resource, an interpretation supported by the lack of a discernable relationship between conservation orientation and both consumptive motivations and attitudes to management.

The explanation provided above has clear implications for fisheries beyond the Tasmanian game fishery, and warrants further research. If the relationships between consumptive attitudes/motivations/orientation and perceptions of scale, accountability, control and custodianship are clarified in a manner that transcends individual fisheries, a reconceptualisation of some of the fundamental relationships underpinning specialisation will be necessary. It will also be an important step in advancing the specialisation concept by providing a contextual framework in which it may be more effectively understood and applied.

In Chapter Five, comparisons between sectors were made in view of the specialisation results obtained in Chapter Four. While it was acknowledged that boat ownership may be viewed as an act of behavioural commitment, and therefore worthy of incorporation within the index used in the previous chapter, the observation of a greater number of 'specialisation independent' than 'specialisation mediated' results vindicated the approach undertaken. It also suggests that some of the relationships observed between sector identification and various independent variables would not have been discernable if 'buried' within an index due to masking affects imposed by other index items.

In relation to how the results from Chapter Five may make a contribution to human dimensions in fisheries literature, a number of insights are offered. Firstly, as a measure of behavioural commitment, boat ownership may be seen as a limiting factor by which specialisation may be either accelerated or impeded by enabling or constraining greater participation and challenges. As such, when viewed as an agent of specialisation, boat ownership may be seen as not only a passive measure, but also as an active facilitator of specialisation. Second, the considerable number of specialisation independent significant differences between sectors suggests that applying the specialisation construct to explore diversity within fishing populations may not fully encapsulate changes in attitudes and behaviours that are afforded by significant expressions of personal commitment, such as the purchase of equipment required for independent participation. Accordingly, in lieu of further contextual development of recreational specialisation, the concept may not be a panacea for exploring diversity, and researchers are encouraged to investigate additional criteria that may be used to evaluate fishing populations.

Third, the results provide additional evidence of the need for further research required to provide context for more effective application of specialisation theory. With regard to the context provided by sector identification, some of the results presented in this chapter may be applicable to fisheries with comparable 'sectors'. Of particular note is the relationship between

specialisation and attitudes to restrictive management measures. The results suggest that owning a boat engenders fishers with less supportive attitudes toward restrictive measures – attitudes that weren't consistent with fisher's conservation orientation. These observations were interpreted in light of protecting ones 'investment' (i.e. the financial capital required to provide participants with access to fishing opportunities) and the relative difficulties involved in substituting activities if restrictions make it harder to attain expected outcomes. While this interpretation is plausible, and supported by results from Ditton *et al.* (1998), the implications for the further development of the specialisation theory suggest that financial expressions of behavioural commitment is one area that requires further investigation.

The results of Chapter Six sustain the overarching hypothesis that catch and release decisions are a function of both personal and situational factors and provide general support for the framework proposed by Sutton (2001). The identification of significant factors untested in previous studies suggests that fish release behaviour is not fully understood and ample scope remains for future studies in this area. Furthermore, differences observed between the two angling populations in this study coupled with inconsistencies with prior studies suggests that, like other dimensions of research on angling populations, results from individual studies may have limited applicability to the wider angling population. However, it is plausible that the results of this study will have greatest relevance for recreational fisheries defined by an array of target species and a catch and release ethic that is not firmly entrenched.

Whilst offering general support for Sutton's (2001) framework on understanding catch and release behaviour, the current study also identified three main areas that require consideration in future re-conceptualisations of the framework. First, the model is underpinned by the assumption that fish released are done so, at least in part, by conservation concerns. While this assumption may be applicable for fisheries where the conservation-related catch and release ethic is well established, the framework will likely have less relevance to other fisheries. Second, the positive relationship between fishery-

based knowledge and fish release behaviour suggests that this previously untested variable (within this context) should be considered in future studies. The salience of the observation was underscored by the non-significance of conservation orientation. It is possible that 'knowledge' may be an effective proxy for conservation orientation as the wording or presentation of the item may avoid the confounding problems identified in Chapter Six. Notwithstanding this, the connection between understanding issues surrounding one's impact on a resource and the development of pro-environmental behaviours is well documented in other fields (Stern *et al.* 1995; Schiller *et al.* 2001; Brown *et al.* 2009). Third, Sutton's (2001) framework assumes that a fisher's consumptive orientation will affect an individual's attitudes to releasing fish, which will in turn influence behaviour. This effectively suggests that a fisher's consumptive orientation is distinct from his or her attitudes to releasing fish, which it is clearly not – particularly the consumptive orientation domain pertaining to releasing fish. As such, it is postulated that the relationship between catch and release behaviour and consumptive orientation is more direct that that proposed by Sutton (2001). Fourth, the highly significant nature of different measures of prior fishing activity suggests that satiation/deprivation effects need to be considered in further re-conceptualisations of the framework to properly understand angler's willingness to release fish. As the implications of this are potential profound, they are discussed at length in the following two paragraphs.

The results of the current study were somewhat consistent with findings reported by Loomis and Fix (2001), who observed that trout anglers placed a higher degree of importance on catching fish on subsequent trips if they did not succeed in catching their preferred size, numbers or species on previous trips. The results from both studies indicate that fishers' attitudes and behaviour relating to fish catch and retention may be largely facultative and circumstantial. This claim has implications for studies that attempt to understand fisher's catch motivations and consumptive orientations. There may also be implications for fisher's attitudes to management imposed restrictions on catch and effort. As these are areas of fundamental relevance to

managers, further research is suggested to better understand this phenomenon. Potentially, research could focus on whether satiation-deprivation effects on behaviour and attitudes vary according to the seasonal availability of fish, characteristics of fish caught/kept and by fisher 'type' according to specialisation or other means of grouping participants. Of the latter, it is plausible that less specialised fishers may be more influenced by previous catch success (and other situational factors) than more specialised fishers, who may be more influenced by personal factors less pervious to prior fishing activity. With regard to the characteristics of fish caught and kept, satiation effects on retention behaviour may be influenced by fish size and be more pronounced with larger fish species due to the greater volume of food and the ability to freeze fish for later use.

The relationship between previous fishing activity and attitudes and behaviour relating to fish catch and retention has further research implications. First, it may distort the distinction between personal and situational factors as predictors of catch and release behaviour. If attitudes to releasing fish fluctuate according to what was caught and/or kept on previous trip/s, it could be argued that such attitudes function in a circumstantial manner similar to situational variables. Second, satiation-deprivation effects may distort the interpretation of the relationship between attitudes and behaviour relating to fish catch and retention, and avidity. While many studies claim that the importance of catch and retention factors is lower among anglers who fish more often – usually within the context of recreational specialisation – the impact of satiation-deprivation effects on this relationship is generally not addressed.

The results from Chapter Seven provide preliminary support for the hypothesis that fishers with a positive attitude to catch and release fishing should be willing to pay more to go fishing. Nonetheless, other results pertaining to both attitudinal and behavioural measures of catch and release participation were somewhat contradictory. Explanations for the conflicting results were based on the inherent variability in multiple species fisheries and the wording of survey items. Recommendations for further research were

made in light of the challenges presented in this study. Despite these challenges however, the successful demonstration of reliability and construct validity within the data models suggest that the methodology employed could serve as a guide for future contingent valuation studies on small populations of fishers. The general movement from quantitative open-ended or iterative bidding approaches to qualitative closed-ended question formats has implications for small study populations: the NOAA suggests that while preferable, closed-ended CV format require at least 1000 respondents to produce reliable results (Arrow *et al.* 1993).

8.1.1 Implications for sampling methodologies

Numerous methodological inferences for future research may be drawn from this study. While many of these have been discussed already, three broad implications will be outlined, particularly in reference to collecting data within relatively small fisheries and in the absence of a comprehensive sampling frame.

First, in relation to the telephone administered diary survey, the large volume of information collected from a relatively small number of respondents, coupled with a low 'drop out' rate, underscores the value of this methodology in the collection of accurate trip related data. While this type of survey is resource intensive compared to mail surveys, the ability to collect data from many trips from a single respondent lends itself to fisheries with a limited number of participants, particularly if they are difficult to access. Rapport development between interviewers and respondents over successive interviews is furthermore conducive to the collection of supplementary information, as was demonstrated in this study.

Second, in relation to the charter boat fisher's questionnaire, the high variability in rates of survey distribution among charter boat operators (CBOs) underscores a caveat implicit in using a third party to distribute surveys. The cost advantages of questionnaire distribution using CBOs are clear; however, if this method is to be advocated for future research, efforts should be

undertaken to investigate means to address the high variability in participation of CBOs and hence potential sampling biases among respondents.

Third, the use of the State boat registration database to access private boat fishers overlooked fishers who did not own boats. While the sampling bias implications of this method have been discussed, and the results of this study should be viewed within this context, future researchers accessing fishers in a similar manner should be mindful of these limitations and, where possible, employ other means to identify and sample non-boat owners – either to supplement the data or to determine whether boat owners are representative of the wider population of private boat fishers.

8.2 Implications for the management of the Tasmanian gamefishery

In this section, the implications of this study for the management of the Tasmanian gamefishery are considered. First, the perceived capacity of the management structure to utilise research findings will be discussed, and compared with other fisheries. Second, the findings will be discussed in reference to three apparent and/or emerging issues facing the fishery – increasing pressure on fish stocks, post-release survival of game fish and anticipated climate change mediated effects on game fish distribution and abundance. In doing so, particular relevance will be made to EBFM. Furthermore, further research suggestions will be identified.

With the relatively recent shift in focus from maximum to optimum sustainable fisheries management, addressing the needs of fishers may be viewed as being of equal importance to addressing the needs of fish populations (Peyton and Gigliotti, 1989; Hahn, 1991). From a human dimensions perspective, maximising angler satisfaction (within a framework of biological sustainability) should be the ultimate goal of fisheries managers. To achieve this, however, there are limitations on the number of determinants of angler satisfaction that managers can effectively manipulate. Due to the highly migratory nature of the pelagic game fish that frequent Tasmanian waters, local management efforts can exert very little control over the quality of the fishery, in terms of fish numbers and size. This scenario is very

different from managing fisheries based on localised fish populations, whereby recreational fishing regulations can have appreciable consequences on the population dynamics of fish communities (McPhee *et al.* 2002; Post *et al.* 2003; Lewin *et al.* 2006). Accordingly, limitations on the degree to which the management apparatus can utilise socioeconomic data to alter the experiences of fishers are imposed. The results of this study relating to anglers' consumptive orientation and catch-related motivations are a case in point – numerous studies suggest that by identifying angler heterogeneity in relation to the number, size and species of fish that anglers prefer to catch and/or keep will allow managers to tailor fishing experiences accordingly. This assumption is especially true of specialisation-based research, which has its roots in managing trout fishers: Here, managers may effectively attend to differently oriented fishers through targeted management regimes of independent water bodies; that is, catch and release oriented fishers and harvest oriented fishers can be catered for by the management of catch and release 'trophy' waters and 'put and take' fisheries, respectively. While resource conditions cannot be manipulated in a similar fashion for the Tasmanian game fishery, obligations to observe stock sustainability by constraining catch and effort can be achieved in a manner designed to minimise angler dissatisfaction and displacement. The Tasmanian gamefishing management framework may also incorporate the outcomes of socioeconomic studies to address issues relating to access, facilities, barriers to participation, education programs and angler conflicts such as overcrowding.

8.2.1 Pressure on game fish populations

Tasmania's role as a minor player in the exploitation of highly migratory fish species effectively means that managing the recreational fishery to attend to the needs of consumptively oriented fishers should not be at odds with the attainment of satisfying angling experiences by fishers who may prefer to catch larger fish and/or release fish. Accordingly, the scope for potential intra-sectoral resource conflicts is also reduced. Nonetheless, as a stakeholder in the overall management of game fish species, Tasmanian fisheries managers have

an obligation to manage the fishery in a sustainable manner, and in accordance with national and international agreements and conventions. In relation to SBT, Australia is currently facing pressure to quantify its recreational take in light of its (commercial) quota under the CCSBT (CCSBT, 2006; 2007), which does not provide for a recreational component. Anecdotal reports suggesting that the recreational SBT fishery is expanding in Tasmanian and other Australian State waters (J. Lyle pers. comm.) are likely to contribute to this pressure. Pending the outcome of these developments, it is possible that obligations will be imposed on management authorities in Australia to constrain the SBT harvest. Given the widely recognised iconic status of SBT as a recreational species in Tasmania (Morton and Lyle, 2003; Forbes *et al.* 2009), coupled with the observation that SBT was the most popular target species among more specialised fishers[56] in this study, the outcomes of this process may have considerable social (and economic) consequences for Tasmanian fishers and coastal communities. In recognition of this, comparative valuation studies could inform a re-allocation of the current SBT quota to allow for a specific recreational component; either as part of or in addition to the current commercial quota. Whether or not this course of action is pursued, the social value of the recreational fishery could be attended to by imposing an explicit recreational allocation, similar to that allocated for recreational (and customary) SBT fishers in New Zealand.

Late in 2009, the Australian Government, as a signatory to the Convention on Migratory Species (CMS), imposed a ban on retaining mako and porbeagle sharks. Under the EPBC Act, the Australian Government was obliged to endorse the recommendations of the CMS which imposed an "endangered" classification on these pelagic sharks. Amid public condemnation from recreational fishers, the ban was overturned due to the assertion by the Australian Government that Australian populations of these species were less depleted than international populations on which the classification was based. While this outcome was welcome news for shark fishers, issues surrounding

[56] As anglers were only able to nominate a preferred species from ones they had caught, it is reasonable to assume that a greater proportion of lesser specialised fishers (many of whom had not caught SBT), would also nominate SBT as their most preferred species if they had caught one.

the recreational exploitation of pelagic sharks will likely resurface due to a combination of life history characteristics and increasing rates of exploitation that make pelagic sharks very vulnerable (Barker and Schluessel, 2004; Dulvy *et al.* 2008), further obligations as signatories to the CMS and the *International Plan of Action for the Conservation and Management of Sharks*, and the incremental protection of other shark species in Australia such as the great white shark (*Carcharadon carcharias*) and grey nurse shark (*Carcharias taurus*). The present study identified a proportion of the Tasmanian game fishery that targeted pelagic sharks exclusively, and others who targeted both sharks and tuna species. In view of the likelihood of further resource-based issues, future studies should aim to better understand this game fishing sub-population. In particular, understanding fisher's attitudes to catch and release fishing and the substitutability of shark fishing with other activities (or fishing target species) should be investigated.

In addition to the issues relating to SBT and pelagic sharks, long term population trends of exploited large pelagic fish stocks (Myers and Worm, 2003; 2005) suggest a similar future predicament for game species that frequent Tasmanian waters. Given the reasonable likelihood of future harvest constraints, it is paramount to consider how such measures may be perceived and received by fishers. From a human dimensions perspective, encouraging voluntary catch and release fishing is preferable to reducing harvest through fishing regulations. Furthermore, and in view of EBFM principles, encouraging voluntary catch and release behaviour is likely to lead to preferable ecosystem outcomes as reducing possession limits may displace effort of consumptively oriented fishers to other species or fisheries with higher possession limits (Woodward and Griffin, 2003). The observation of higher rates of fish retention by charter boat fishers, coupled with evidence of a progression from charter boat to private boat fishing through an individual's fishing 'career' suggests that collaborative efforts between managers and charter boat operators to encourage responsible fishing practices may, if successful, encourage longer-term responsible angling practices.

In support of this claim, the significance of angler's knowledge of game fish sustainability as a predictor of fish release behaviour further suggests that 'excess' fish are retained, in part, out of ignorance of sustainability issues. Accordingly, education programs targeted to fishers, perhaps through charter boat operators, may help instil a catch and release ethos among fishers and preclude the need for highly restrictive harvest measures such as those that apply to the northern bluefin tuna fishery in the United States (Ditton *et al.* 1998). According to Gray and Jordan (2010), engaging with fishers about their role and potential impacts within ecosystems is a key obligation imposed on fisheries managers through the implementation of EBFM. Gray and Jordan further contend that while the majority of saltwater fishers perceive their impacts to be negligible, particularly when compared to the perceived impacts of commercial fishing, fishers are generally receptive to information on how they can minimise their impact on the resource from which they derive benefit.

If efforts to promote voluntary catch and release are not considered sufficient to reduce fishery impacts, the results of this study suggest that satisfying fishing experiences can still be attained by most fishers provided scope exists to retain at least one of the larger tunas or pelagic sharks, and up to five albacore tuna. These regulation preferences are somewhat consistent with the overall consensus on fishing motivations: between fishing 'sectors' and levels of specialisation, non-catch motivations were, at an aggregate level, considered to be more important than catch-related motivations. However, this observation, which is consistent with numerous other studies across various fisheries, should not be interpreted to suggest that catch motivations are not important and/or fishers would still choose to fish without the option of retaining fish. As suggested by Green (1988) and Matlock *et al.* (1991), with the exception of a few 'catch and release fisheries' that are largely confined to freshwater, the option of being able to retain fish remains a chief factor underpinning and defining the fishing experience. The retention rates for both private boat and charter boat fishers in this study accord with this, indicating a considerable consumptive focus of Tasmanian game fishers, despite some inconsistencies observed between consumptive attitudes and behaviour.

Nonetheless, in the face of dwindling fish resources, Cook *et al.* (2001) contend that high possession limits can actually lead to dissatisfaction among anglers by providing unrealistic expectations, which may provoke angler dissatisfaction when thwarted. Consistent with this contention is the assertion by Hudgins and Davies (1984) that angler satisfaction is largely dependent on the difference between expected and actual outcomes. Cook *et al.* (2001) further suggest that, over time, possession limits should function as an educational tool to help anglers develop a more realistic expectation of the capacity of a fishery to sustainably absorb a given level of effort.

Other results of this study also have implications for addressing harvest reductions by the recreational fishery, whilst minimising angler displacement and dissatisfaction. Among all fisher groups examined, the strong orientation to catching large fish compared to catching many fish, and the observation of a strong relationship between fish release behaviour and fishing effort over the course of a fishing season may be viewed as potential support for size limits and seasonal harvest limits, respectively, relative to alternative constraints. Whatever measures are considered to address future angler harvest, careful attention should be taken to minimise angler dissatisfaction and maximise the social and economic value of the recreational fishery. While the results of this study may be viewed as a detailed baseline, specific proposals to address resource issues should engage fishers to help understand the potential effects of proposed measures. As a resource characterised by complex arrangements for management and exploitation, the maximisation of fishery value needs to be viewed within the context of all stakeholders. As such, future research should also focus on determining the most efficient use of fish resources, possibly by comparing net economic benefits between recreational and commercial fisheries. Where research of this nature has been undertaken for gamefish, the results are generally favourable for recreational fishers (Ditton and Stoll, 2003; Ernst and Young, 2004).

8.2.2 Post release survival and fitness

Management efforts to address stock sustainability also highlight the need for a better understanding of post-release survival of fish, particularly in light of the paucity of such research on large pelagic fish (Skomal, 2007). Without addressing this issue, it cannot be assumed that all fish released by anglers survive or suffer no sub-lethal physiological effects. According to Skomal (2007), future studies addressing post-release survivorship should consider the use of pop-up satellite archival tags, and effort made to mimic actual fishing practices. In doing so, the relative contributions of different potential impactors (ie playing time, handling stress, tissue damage) on survival may be more readily assessed. The outcomes of such research may have direct implications for the fishing behaviour of anglers. For example, management efforts may be required to encourage anglers to use different gear, engage fish in shorter playing times and/or use different handling techniques. Of immediate concern for the Tasmanian fishery are incidental mortalities of fish arising from seal interactions. Anecdotal reports plus data collected but not reported in this study suggest that a considerable number of fish are released in the presence of predatory Australian fur seals (*Arctocephalus pusillus*), or are lost to seals during the catching process[57]. The unreported data further suggest that landed seal-damaged fish are generally not included in fishers possession limits; a situation that also warrants attention. It is possible that these impacts on fish stocks may offset benefits accrued by releasing fish, and therefore erode any increases in value to the fishery that might otherwise occur. Therefore, further research in this area may be viewed as a necessary precursor to efforts in promoting catch and release fishing. This is of particularly relevance to SBT, on which many of the reports of seal interactions are centred.[58]

[57] 44 of the 99 respondents in the telephone administered supplementary survey reported having fish damaged through seals attacks

[58] Of the 99 respondents in the telephone administered supplementary survey, 214 SBT hooked were reported to be damaged by seals

8.2.3 Climate change

Another pertinent issue facing the management of the game fishery is the anticipated effects of climate change on fish stocks and the consequent implications for fishers. According to Hobday (2010), the distribution of large pelagic fish that utilise the East Australia Current will likely move southwards at approximately 45 km per decade and contract in area due to a poleward extension of the East Australian Current. Hobday's research suggest that there is a high probability that rarely encountered species (i.e. broad billed swordfish, wahoo, dolphinfish, oceanic whitetip shark, bigeye tuna) will become more commonplace in Tasmanian waters. Furthermore, species generally more common in north eastern than south eastern Tasmanian waters (i.e. yellowfin tuna, striped marlin) will likely become more evenly distributed along Tasmania's east coast as they extend their range southward. Although the uncertainty inherent in modelling such changes was acknowledged by Hobday (2010: 300), he asserts that "a change in horizontal distribution may result in increased availability to fishers". Relative to other States, it appears that Tasmanian game fishers may be the beneficiaries of such changes. Consequently, it is likely that Tasmania's gamefishing opportunities will expand, and the fishery may attract a greater number of fishers, including those from other States. While this prediction may be good news for charter boat operators and regional economies, there are significant implications for those involved in managing the fishery.

As a consequence of managing a larger percentage of the standing biomass of a greater number of species, it is reasonable to conclude that stakeholders in the management of Tasmania's game fishery will be imbued with greater responsibilities and will need to address increasingly complex issues. Capacity may be required to attend to the State, national and international frameworks and resource sharing agreements for a greater number of highly migratory species. As for managing recreational fishers, the combined likelihoods of whole-of-fishery biomass declines and climate change mediated distribution shifts will likely place pressure on managers to reduce harvest whilst providing satisfying angling experiences. Difficulties may be

encountered in encouraging acceptance of and compliance with more restrictive regulations in the face of localised increased catch and species abundance: Slovic (1979) illustrates that people's perceptions of environmental impacts are generally biased by anecdotal or personal experiences, even in light of larger scale information.

The anticipated arrival of 'new' species in Tasmanian waters may also necessitate a re-evaluation of game fishers in terms of species type targeted. The present study demonstrates the existence of 'general' game fishers and a smaller sub-population who exclusively target pelagic sharks; however, future studies may also identify another subset of anglers who primarily target smaller gamefish such as yellowtail kingfish, wahoo and dolphinfish. Identifying and attending to a greater diversity of fishers with differing attitudes, orientations, values and behaviours will likely be a growing challenge for the management framework. The introduction of a licensing system could partially address these challenges by enabling a greater understanding of recreational take, provide a sampling frame for surveys, and facilitating greater efficiency in the dissemination of fishery-based education material.

An anticipated increase in the number of game fishers has further implications for managing angler conflicts and increased pressure on fishing related facilities. In regard to the latter, the congestion of boat ramps and parking facilities during peak fishing times have become well publicized local issues (The Mercury, 2007). Future angling participation may require the expansion and or/duplication of such facilities. Conflicts between game fishers, with non-game fishers and other water users will likely require the engagement of the fisheries management framework and other management authorities to address these issues. While managers have little control over many of the non-catch motivational factors measured in this study, an obligation exists to enable fishers to continue to derive satisfaction from the natural and psychological attributes (i.e. escapism and relaxation) of the fishing experience by alleviating conflict, congestion and over-crowding.

References

Aas, O. (2002) The Next Chapter: Multi-cultural and cross-disciplinary progress in evaluating recreational fisheries. In: T.J. Pitcher & C. Hollingworth (eds.) *Recreational fisheries: ecological, economic and social evaluation.* Oxford: Blackwell Science.

Aas, O. & Kaltenborn, B.P. (1995) Consumptive orientation of anglers in Engerdal, Norway. *Environmental Management,* **19,** 751-761.

Aas, O., Thailing, C.E. & Ditton, R.B. (2002) Controversy over catch and release fishing in Europe. In: T.J. Pitcher & C. Hollingworth (eds.) *Recreational Fisheries: Ecological, Economic and Social Evaluation.* Oxford: Blackwell Science.

Adamowicz, W., Louviere, J. & Williams, M. (1994) Combining stated and revealed preference methods for valuing environmental ammenities. *Journal of Environmental Economics and Management,* **26,** 271-292.

Ajzen, I. (1991) The theory of planned behaviour. *Organisational Behaviour and Human Decision Processes,* **50,** 179-211.

Ajzen, I. & Fishbein, M. (1980) *Understanding Attitudes and Predicting Social Behaviour,* Engelwood Cliffs, NJ: Prentice Hall, Inc.

Anderson, D.K., Ditton, R.B. & Hunt, K.M. (2007) Measuring angler attitudes toward catch-related aspects of fishing. *Human Dimensions of Wildlife,* **12,** 181-191.

Anderson, L.E., Loomis, D.K. & Salz, R.J. (2004) Constraints to recreational fishing: concepts and questions to understand underrepresented angling groups. *Proceedings of the 2004 North-eastern Recreational Research Symposium.*

Anderson, T. (2006) Chasing mako sharks. *Tasmanian Fishing and Boating News.* Launceston: Mike Stevens Publishing.

Antia, U., Haider, W. & Ditton, R.B. (2002) Understanding angler's preferences for fishing tournament characteristics and policies. *Environmental Management,* **40,** 123-133.

Arlinghaus, R. & Cooke, S.J. (2005) Global impact of recreational fisheries. *Science,* **307,** 1561-1562.

Arlinghaus, R., Cooke, S.J., Lyman, J., Policansky, D., Schwab, A., Suski, C.D., Sutton, S. & Thorstad, E.B. (2007) Understanding the complexity of catch and release in recreational fishing: an integrative synthesis of global knowledge from historical, ethical, social and biological perspectives. *Reviews in Fisheries Science,* **15,** 75-167.

Arlinghaus, R., Cooke, S.J., Schwab, A. & Cowx, I.G. (2007) Fish welfare: a challenge to the feelings based approach with implications for recreational fishing. *Fish and Fisheries,* **8,** 57-71.

Arlinghaus, R. & Mehner, T. (2003) Socio-economic characterisation of specialised common carp anglers in Germany, and implications for inland fisheries management and eutrophication control. *Fisheries Research,* **61,** 19-33.

Arlinghaus, R. & Mehner, T. (2004) Testing the reliability and construct validity of a simple and inexpensive procedure to measure the use value of recreational fishing. *Fisheries Management and Ecology,* **11,** 61-64.

Baker, D.L. & Pierce, B.E. (1997) Does fisheries management reflect societal values? Contingent valuation evidence for the River Murray. *Fisheries Management and Ecology,* **4,** 1-15.

Barker, M.J. & Schluessel, V. (2004) Managing global shark fisheries: suggestions for prioritizing management strategies. *Aquatic Conservation: Marine and Freshwater Ecosystems,* **15,** 325-347.

Bartholomew, A. & Bohnsack, J.A. (2005) Catch and release angling mortality with implications for no-take reserves. *Reviews in Fish Biology and Fisheries,* **15,** 129-154.

Bartlett, M.S. (1954) A note on the multiplying factors for various chi square approximations. *Journal of the Royal Statistical Society,* **16,** 296-298.

Bateman, I.J., Langford, I.H., Turner, R.K., Willis, K.G. & Garrod, G.D. (1995) Elicitation and truncation effects in contingent valuation studies. *Ecological Economics,* **12,** 161-179.

Bohnsack, B.L., Ditton, R.B., Stoll, J., Chen, R.J., Novack, R. & Smutko, L.S. (2002) The economic impacts of the recreational bluefin tuna fishery in Hatteras, North Carolina. *North American Journal of Fisheries Management,* **22,** 165-176.

Boyle, K.J. & Bishop, R.C. (1988) Welfare measurements using contingent valuation: A comparison of techniques. *American Journal of Agricultural Economics,* **70,** 21-28.

Brinson, A.A., Die, D.J., Bannerman, P.O. & Diatta, Y. (2009) Socioeconomic performance of West African fleets that target Atlantic billfish. *Fisheries Research,* **99,** 55-62.

Brown, T., L (1991) Use and abuse of mail surveys in fisheries management. *American Fisheries Society Symposium,* **12,** 255-261.

Brown, T.L., Dawson, C.P., Hustin, D.L. & Decker, D.J. (1981) Comments on the importance of late respondent and non-respondent data from mail surveys. *Journal of Leisure Research,* **13,** 76-79.

Brown, T.L., Decker, D.J. & Connelly, N.A. (1989) Response to mail surveys on resource-based recreation topics: A behavioural model and an empirical analysis. *Leisure Sciences,* **11,** 99-110.

Browne, M., Pagad, S. & De Poorter, M. (2009) The crucial role of information exchange and research for effective responses to biological invasions. *Weed Research,* **49,** 16-18.

Bryan, H. (1977) Leisure value systems and recreation specialisation: The case of trout fishermen. *Journal of Leisure Research,* **9,** 174-187.

Bryan, H. (1979) Conflict in the Great Outdoors. *Sociological Studies No. 4*

Bryan, H. (2000) Recreation specialisation revisited. *Journal of Leisure Research,* **32,** 18-21.

Buchanan, T. (1985) Commitment and leisure behaviour. *Leisure Sciences,* **7,** 401-420.

Carson, R.T. (2000) Contingent Valuation: A user's guide. *Environmental Science and Technology,* **34,** 1413-1418.

Caton, A.E. (1994) Commercial and recreational components of the southern bluefin tuna (*Thunnus macoyii*) fishery. *Interactions of Pacific Tuna Fisheries. FAO Fisheries Research Paper 336/2* No. 344-369 pp.

Chipman, B.D. & Helfrich, L.A. (1988) Recreational specialisation and motivations of Virginia river anglers. *North American Journal of Fisheries Management,* **8**, 390-398.

Choi, S., Ditton, R.B. & Matlock, G.C. (1992) Homogeneity across mail survey waves: a replicated study. *Journal of Leisure Research,* **24,** 79-85.

Choi, S., Loomis, D.K. & Ditton, R.B. (1994) Effect of social group, activity, and specialisation on recreation substitution decisions. *Leisure Sciences,* **16,** 143-159.

Coakes, S., Gabriel, M., Consulting, C., Brooks, K. & Charalambou, C. (2001) The right bait - social contributions of tourism fishing charter operations to St Helens, Tasmania. No. 36 pp.

Cole, J. & Scott, D. (1999) Segmenting participation in wildlife watching: A comparison of casual wildlife watchers and serious birders. *Human Dimensions of Wildlife,* **4,** 44-61.

Commission for the Conservation of Southern Bluefin Tuna (2006) *Report of the Thirteenth Annual Meeting of the Commission.* The Commission, Canberra.

Commission for the Conservation of Southern Bluefin Tuna (2007) *Report of the Twelfth Meeting of the Scientific Committee.* The Commission, Canberra.

Commonwealth of Australia (1992) *The National Strategy for Ecologically Sustainable Development.* AGPS, Canberra. <http://www.ea.gov.au>

Connelly, N.A., Brown, T.L. & Decker, D.J. (2003) Factors affecting response rates to natural resource-focused mail surveys: Empirical evidence of declining rates over time. *Society and Natural Resources,* **16,** 541-549.

Cook, M.F., Goeman, T.J., Radomski, P.J., Younk, J.A. & Jacobson, P.C. (2001) Creel limits in Minnesota: a proposal for change. *Fisheries,* **26,** 19-26.

Cooke, S.J. & Cowx, I.G. (2005) The role of recreational fisheries in global fish crises. *BioScience,* **54,** 857-859.

Cooke, S.J. & Schramm, H.L. (2007) Catch and release science and its application to conservation and management of recreational fisheries. *Fisheries Management and Ecology,* **14,** 73-79.

Cooke, S.J. & Suski, C.D. (2005) Do we need species-specific guidelines for catch-and-release recreational angling to effectively conserve diverse fishery resources? *Biodiversity and Conservation,* **14,** 1195-1209.

Cramer, J. (2004) Life after catch and release. *Marine Fisheries Review,* **66,** 27-30.

Dawson, C.P. & Wilkins, B.T. (1981) Motivations of New York and Virginia marine boat anglers and their preferences for potential fishing constraints. *North American Journal of Fisheries Management,* **1,** 151-158.

Ditton, R. & Stoll, J. (2003) Social and economic perspective on recreational billfish fisheries. *Marine and Freshwater Research.*

Ditton, R.B. (1996) Human Dimensions in Fisheries. In: A. Ewart (ed.) *Natural Resource Management: The Human Dimension.* Boulder ,CO: Westview Press.

Ditton, R.B. (2002) A Human Dimensions Perspective on Catch and Release Fishing. *American Fisheries Society Symposium.* American Fisheries Society.

Ditton, R.B. (2004) Human Dimensions of Fisheries. In: M.J. Manfredo, J.J. Vaske, B.L. Bruyer, D.R. Field & P. Brown (eds.) *Society of Natural Resources: A summary of Knowledge.* Jefferson, MO: Modern Litho.

Ditton, R.B., Stephen G Sutton (2004) Substitutability in recreational fishing. *Human Dimensions of Wildlife,* **9,** 87-102.

Ditton, R.B., Bohnsack, B.L. & Stoll, J.R. (1998) A Social and Economic Study of the Winter Recreational Atlantic Bluefin Tuna Fishery in Hatteras, North Carolina. No. 70 pp.

Ditton, R.B. & Clarke, D.J. (1994) Characteristics, attitudes, catch and release behaviour and expenditures of billfish tournament anglers in Puerto Rico. Report prepared for the Billfish Foundation, Fort Lauderdale, FL.

Ditton, R.B., Finkelstein, L. & Grimes, S. (2005) Status of ongoing billfish socio-economic studies in Mexico and Costa Rica. In: M. Goodwin & A. Acosta (eds.) *47th Gulf and Caribbean Fisheries Institute.* Nueva Esparta, Venezuela.

Ditton, R.B., Gill, D.A. & MacGregor, C.L. (1991) Understanding the market for charter and headboat fishing. *Marine Fisheries Review,* **53,** 19-26.

Ditton, R.B. & Grimes, S. (1995) A social and economic study of the Costa Rica recreational billfish fishery. Report prepared for the Billfish Foundation, Fort Lauderdale, FL.

Ditton, R.B., Grimes, S.R. & Finkelstein, L.D. (1996) A social and economic study of the recreational billfish fishery in the southern Baja area of Mexico. Report prepared for the International Billfish Research and Conservation Foundation, Fort Lauderdale, FL

Ditton, R.B. & Hunt, K.M. (2001) Combining creel intercept and mail survey methods to understand the human dimensions of local freshwater fisheries. *Fisheries Management and Ecology,* **8,** 295-301.

Ditton, R.B., Loomis, D.K. & Choi, S. (1992) Recreation specialisation: re-conceptualisation from a social world's perspective. *Journal of Leisure Research,* **24,** 33-51

Ditton, R.B., Mertens, T.J. & Schwartz, M.P. (1978) Characteristics, participation and motivations of Texas charter boat fishermen. *Marine Fisheries Review,* **40,** 8-13.

Ditton, R.B. & Sutton, S.G. (2004) Substitutability in recreational fishing. *Human Dimensions of Wildlife,* **9,** 87-102.

Ditton, R.B., Sutton, S.G., Holland, S.M., Stoll, J.R. & Milon, J.W. (2001) A longitudinal perspective on the social and economic characteristics of the U.S. Gulf of Mexico charter and party boat industry. *52nd Gulf and Caribbean Fisheries Institute.* Key West, Florida.

Ditton, R.B., Sutton, S.G., Holland, S.M., Stoll, J.R. & Milon, J.W. (2001) A longitudinal perspective on the social and economic characteristics of the U.S. Gulf of Mexico charter and party boat industry. *Proceedings of the 52nd Gulf and Caribbean Fisheries Institute.* Key West, Florida.

Driver, B.L. (1977) Item pooled scales designed to quantify the psychological outcomes desired and expected from recreation participation. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

Driver, B.L. & Cooksley, R.W. (1977) Preferred psychological outcomes of recreational fishing. In: R.A. Barnhardt & T.D. Roelofs (eds.) *Catch*

and release fishing as a management tool: A national sport fishing symposium. Bethesda, MD: American Fisheries Society.

Driver, B.L. & Knopf, R.C. (1976) Temporary escape: one product of sport fishery management. *Fisheries,* **1,** 21-29.

Dulvy, N.K., Baum, J.K., Clarke, S., Compagno, L.J.V., Cortes, E., Domingo, A., Fordham, S., Fowler, S., M.P., F., Gibson, C., Martinez, J., Musick, J.A., Soldo, A., Stevens, J.D. & Valenti, S. (2008) You can swim but you cant hide: The global status and conservation of oceanic pelagic sharks and rays. *Aquatic Conservation: Marine and Freshwater Ecosystems,* **18,** 459-482.

Eiser, J.R. (1986) *Social Psychology: Attitudes, Cognition and Social Behaviour,* Cambridge, MA: Cambridge University Press.

Ernst & Young (2004) Economic impact of the NSW striped marlin fishery *Report to NSW Fisheries.* 124pp.

Evans, B.S. (1995) Tasmanian tuna charter fishery update, season 1994. No. 15pp

Falk, J.M., Graefe, A. & Ditton, R.B. (1989) Patterns of participation and motivation among saltwater tournament anglers. *Fisheries,* **12,** 10-17.

Fedler, A.J. (2002) To keep or release: Understanding differences in angler behaviour. *American Fisheries Society Symposium 30.* American Fisheries Society.

Fedler, A.J. & Ditton, R.B. (1986) A framework for understanding the consumptive orientation of recreational fishermen. *Environmental Management,* **10,** 221-227.

Fedler, A.J. & Ditton, R.B. (1994) Understanding angler motivations in fisheries management. *Fisheries,* **19,** 6-13.

Fedler, A.J. & Ditton, R.B. (2001) Dropping out and dropping in: A study of factors for changing recreational fishing participation. *North American Journal of Fisheries Management,* **21,** 283-292.

Finn, K.L. & Loomis, D.K. (2001) The importance of catch motives to recreational anglers: the effects of catch satiation and deprivation. *Human Dimensions of Wildlife,* **6,** 173-187.

Fishbein, M. & Ajzen, I. (1975) *Belief, Attitude, Intention and Behaviour: An Introduction to Theory and Research,* Reading, MA: Addison-Wesley.

Fisher, M.F. (1997) Segmentation of the angler population by catch preference, participation, and experience: A management oriented application of recreation specialisation. *North American Journal of Fisheries Management,* **17,** 1-10.

Fisher, M.F. & Ditton, R.B. (1992) Characteristics of billfish anglers in the U.S. Atlantic Ocean. *Marine Fisheries Review,* **54,** 1-6.

Fisher, M.F. & Ditton, R.B. (1993) A social and economic characterisation of the US Gulf of Mexico recreational shark fishery. *Marine Fisheries Review,* **55,** 21-27.

Fisher, M.R. (1996) Estimating the effect of non-response bias on angler surveys. *Transactions of the American Fisheries Society,* **125,** 118-126.

Forbes, E., Tracey, S.R. & Lyle, J.M. (2009) Assessment of the 2008 recreational gamefish fishery of southeast Tasmania, with particular reference to southern bluefin tuna. *Technical Report Series.* No 22pp.

Galeano, D., Langenkamp, D., Levantis, C., Shafron, W. & Redmond, I. (2004) Economic Value of Charter and Recreational Fishing in Australia's Eastern Tuna and Billfish Fishery. *ABARE eReport 04.10* No. 41 pp.

Gendall, P. (2005) Can you judge a questionnaire by its cover? The effect of questionnaire cover design on mail survey response. *International Journal of Public Opinion Research,* **17,** 346-361.

Gentner, B. & Lowther, A. (2002) Evaluating marine sport fisheries in the USA. In: T.J. Pitcher & C. Hollingworth (eds.) *Recreational Fisheries: Ecological, Economic and Social Evaluation.*

Gigliotti, L.M. & Peyton, R.B. (1993) Values and behaviours of trout anglers and their attitudes toward fishery management relative to membership in fishing organisations: A case study. *North American Journal of Fisheries Management,* **13,** 492-501.

Gill, D.A. & Ditton, R.B. (1993) Charter and party boat operators in the US Gulf of Mexico: a social structure perspective. *Marine Fisheries Review,* **55,** 1-11.

Graefe, A. (1981) Understanding diverse fishing groups: The case of drum fishermen. In: H. Clepper (ed.) *Proceedings of the Sixth Annual*

Marine Recreational Fisheries Symposium. Houston, Texas: Sport Fishing Institute, Washington D.C.

Graefe, A. & Fedler, A.J. (1986) Situational and subjective determinants of satisfaction in marine recreational fishing. *Leisure Sciences,* **8,** 275-295.

Graefe, A.R. (1980) The relationship between level of participation and selected aspects of specialisation in recreational fishing. Doctoral Dissertation. College Station: Texas A&M University.

Graefe, A.R. & Ditton, R.B. (1997) Understanding catch and release behaviour among billfish anglers. *Proceedings of the annual Gulf and Caribbean Fisheries Institute,* **49,** 430-455.

Grambsch, A.E. & Fisher, M.F. (1991) Catch and release statistics for U.S. bass and trout anglers. *American Fisheries Society Symposium,* **12,** 390-396.

Gray, S.A. & Jordan, R. (2010) Ecosystem based angling: Incorporating recreational anglers into ecosystem-based management *Human Dimensions of Wildlife,* **15,** 233-246.

Green, T., G (1994) Allocation between commercial and recreational sectors in stressed marine fisheries. *Society and Natural Resources,* **7,** 39-56.

Green, T.G. (1991) Importance of fish consumption to sport fishermen: an economic analysis. *Fisheries,* **16,** 13-18.

Hahn, J. (1991) Angler specialisation: Measurement of a key sociological concept and implications for fisheries management decisions. *American Fisheries Society Symposium,* **12,** 380-389.

Hendee, J.C. (1974) A multiple satisfaction approach to game management. *Wildlife Society Bulletin,* **2,** 104-113.

Henry, G.W. and Lyle, J.M., 2003. The National Recreational and Indigenous Fishing Survey. Final Report to the Fisheries Research & Development Corporation and the Fisheries Action Program. Project No. 1999/158. NSW Fisheries Final Report Series No. 48. ISSN 1440-3544. 188pp.

Hensher, D., Louviere, J. & Swait, J. (1999) Combining sources of preference data. *Journal of Econometrics,* **89,** 197-221.

Hobday, A.J. (2010) Ensemble analysis of the future distribution of large pelagic fishes off Australia. *Progress in Oceanography*, **86,** 291-301.

Hoehn, J.P. (1987) Contingent valuation in fisheries management: The design of satisfactory contingent valuation formats. *Transactions of the American Fisheries Society,* **116,** 412-419.

Holland, S., M., Ditton, Robert, B. and Graefe, Alan, R. (1998) An Ecotourism Perspective on Billfish Fisheries. *Journal of Sustainable Tourism,* **6,** 97-115.

Holland, S.M. & Ditton, R.B. (1992) The U.S. Gulf of Mexico charter boat industry: Activity centres, species targeted, and fisheries management opinions. *Marine Fisheries Review,* **54,** 21-36.

Holland, S.M., Fedler, A.J. & Ditton, R.B. (1986) The group representative bias: Another look. *Leisure Sciences,* **8,** 79-91.

Holmes, J.M. (1946) Meeting the demands of the future angler. *Transactions of the North American Wildlife Conference,* **11,** 473-477.

Hudgins, M.D. & Davies, W.D. (1984) Probability angling: A recreational fishery management strategy. *North American Journal of Fisheries Management,* **4,** 431-439.

Hunt, K.M. & Ditton, R.B. (1997) The social context of site selection for freshwater fishing. *North American Journal of Fisheries Management,* **17,** 331-338.

Hunt, L., Haider, W. & Armstrong, K. (2002) Understanding the fish harvesting decisions by anglers. *Human Dimensions of Wildlife,* **7,** 75-89.

Hunter, G.N. (1949) The utility of personal interviews in obtaining information on game and fish resources. *Transactions of the North American Wildlife Conference,* **14,** 239-252.

Hutt, C.P. & Bettoli, P.W. (2007) Preferences, specialisation and management attitudes of trout anglers fishing in Tennessee tailwaters. *North American Journal of Fisheries Management,* **27,** 1257-1267.

Hvengaard, G., T (2002) Birder specialisation differences in conservation involvement, demographics, and motivations. *Human Dimensions of Wildlife,* **7,** 21-36.

Kaiola, P.J., Williams, M.J., Stewart, P.C., Reichelt, R.C., McNee, A. & Grieve, C. (1993) *Australian Fisheries Resources*: Bureau of Resource Sciences, Australian and Fisheries Resources Development Corporation.

Kaiser, H. (1974) An index of factorial simplicity. *Psychometrika,* **39,** 31-36.

Kearney, R.E. (2002) Recreational fishing: value is in the eye of the beholder. In: T.J. Pitcher & C. Hollingworth (eds.) *Recreational Fisheries: Ecological, Economic and Social Evaluation.*

Kim, S.S., Scott, D. & Crompton, J.M. (1997) An exploration of the relationships among social psychological involvement, behavioural involvement, commitment and future intentions in the context of bird watching. *Journal of Leisure Research,* **29,** 320-341.

King, F.D. (1948) The management of man. *Wisconsin Conservation Bulletin,* **13,** 9-11.

Knopf, R.C., Driver, B.L. & Bassett, J.R. (1973) Motivations for fishing. *Transactions of the North American Wildlife and Natural Resources Conference* **38,** 28-41.

Kuentzel, W.F. & McDonald, C.D. (1992) Differential effects of past experience, commitment and lifestyle dimensions on river use specialisation. *Journal of Leisure Research,* **24,** 269-287.

Kyle, G., Norman, W., Jodice, L., Graefe, A. & Marsinko, A. (2007) Segmenting Anglers Using Their Consumptive Orientation Profiles. *Human Dimensions of Wildlife,* **12,** 115-132.

Lee, J.H. & Scott, D. (2004) Measuring birder specialisation: a confirmatory factor analysis. *Leisure Sciences,* **26,** 245-260.

Lewin, W.C., Arlinghaus, R. & Mehner, T. (2006) A review of documented and potential biological impacts of recreational angling: Insights for conservation and management. *Reviews in Fisheries Science,* **14,** 305-367.

Loomis, D.K. & Ditton, R.B. (1987) Analysis of motive and participation differences between saltwater sport and tournament fishermen. *North American Journal of Fisheries Management,* **7,** 482-487.

Lyle, J.M., Tracey, S.R., Stark, K.E. & Wotherspoon, S. (2009) 2007/08 survey of recreational fishing in Tasmania. Tasmanian Aquaculture and Fisheries Institute, Internal Report, 97p.

Manfredo, M.J., Brown, P.J. & G.E., H. (1978) Fisherman values in wilderness. *Proceedings of the Annual Meeting Western Association of Fish and Wildlife Agencies.*

Marasco, R.J., Goodman, D., Grimes, C.B., Lawson, P.W., Punt, A.E. & Quinn, T.J. (2007) Ecosystem based fisheries management: some practical suggestions. *Canadian Journal of Fisheries and Aquatic Sciences,* **64,** 928-939.

Marshall, N.A. & Fenton, D.M. (2005) How social science can help the fishing industry. In: C.R.R. Centre (ed.).

Marta, P., Bochechas, J. & Collares-Pereira, M.J. (2001) Importance of recreational fisheries in the Guadiana River basin in Portugal. *Fisheries Management and Ecology,* **8,** 345-354

Martin, S.R. (1997) Specialisation and differences in setting preferences among wildlife viewers. *Human Dimensions of Wildlife,* **2,** 1-18.

Matlock, G.C., Saul, G.E. & Bryan, C.E. (1988) Importance of fish consumption to sport fishermen. *Fisheries,* **13,** 25-26.

McGlennon, D. (1994) Recreational Fishing: What's the Catch? In: D.A. Handcock (ed.) *Australian Society of Fish Biology Workshop.* Canberra, Australia: Australian Society for Fish Biology.

McIntyre, N. & Pigram, J.J. (1992) Recreation specialisation re-examined: The case of vehicle-based campers *Leisure Sciences,* **14,** 3-15.

McPhee, D. (2008) *Fisheries Management in Australia,* Sydney: Federation Press.

McPhee, D., Leadbitter, D. & Skilleter, G.A. (2002) Swallowing the bait: Is recreational fishing in Australia ecologically sustainable? *Pacific Conservation Biology,* **8,** 40-51.

Milon, J.W. (1991) Measuring the economic value of anglers' kept and released catches. *North American Journal of Fisheries Management,* **11,** 185-189.

Mitchell, R.C. & Carson, R.T. (1989) *Using Surveys to Value Public Goods: the Contingent Valuation Method.* Washington, DC: Resources for the Future, 463 pp.

Morton, A. & Lyle, J.M. (2003) Preliminary assessment of the recreational gamefish fishery in Tasmania with particular reference to southern bluefin tuna. *Technical Report Series* No. 3.

Myers, R.A. & Worm, B. (2003) Rapid worldwide depletion of predatory fish communities. *Nature,* **423,** 280-284.

Myers, R.A. & Worm, B. (2005) Extinction, survival or recovery of large predatory fish species. *Philosophical Transactions of the Royal Society,* **360,** 13-20.

Newhouse, M. (1990) Implications of attitude and behaviour research for environmental conservation. *Journal of Environmental Education,* **22,** 26-31.

Oh, C.O. & Ditton, R.B. (2006) Using recreation specialisation to understand multi-attribute management preferences. *North American Journal of Fisheries Management,* **28,** 369-384.

Oh, C.-O. & Ditton, R.B. (2008) Using recreation specialisation to understand conservation support. *Journal of Leisure Research,* **40,** 556-573.

Oh, C.-O., Ditton, R.B., Anderson, D.K., Scott, D. & Stoll, J. (2005) Understanding differences in non-market valuation by angler specialisation level. *Leisure Sciences,* **27,** 263-277.

Oh, C.-O., Ditton, R.B. & Riechers, R. (2007) Understanding Anglers Preferences for Fishing Tournament Characteristics and Policies. *Environmental Management,* **40,** 123-133.

O'Malley, J.M. & Glazier, E.W. (2001) Motivations, Satisfaction and Expenditures of Recreational Pelagic Charter Fishing Patrons in Hawaii. *SOEST 01-03, JIMAR Contribution 01-339* No. 46 pp.

Pallant, J. (2007) *SPSS Survival Manual: A step-by-step guide to data analysis using SPSS for Windows (Version 15)* Sydney: Allen & Unwin.

Peyton, R.B. & Gigliotti, L.M. (1989) The utility of sociological research: A re-examination of the East Matagorda Bay experience. *Fisheries,* **14,** 5-8.

Policansky, D. (2002) Catch and release fishing: a historical perspective. In: T.J. Pitcher & C. Hollingworth (eds.) *Recreational Fisheries: Ecological, Economic and Social Evaluation.* Oxford: Blackwell Science.

Post, J.R., Mushens, C., Paul, A. & Sullivan, M. (2003) Assessment of alternative harvest regulations for sustaining recreational fisheries: model development and application to bull trout. *North American Journal of Fisheries Management,* **23,** 22-34.

Salz, R.J. & Loomis, D.K. (2005) Recreation specialisation and anglers' attitudes towards restricted fishing areas. *Human Dimensions of Wildlife,* **10,** 187-199.

Salz, R.J., Loomis, D.K. & Finn, K.L. (2001a) Development and validation of a specialisation index and testing of specialisation theory. *Human Dimensions of Wildlife,* **6,** 239-258.

Salz, R.J., Loomis, D.K., Ross, M.R. & Steinback, S.R. (2001b) A baseline socioeconomic study of Massachusetts' marine recreational fisheries *National Oceanic and Atmospheric Administration Technical Memorandum*, NMFS-NE-165.

Scandol, J.P., Holloway, M.G., Gibbs, P.J. & Astles, K.L. (2005) Ecosystem based fisheries management: an Australian perspective. *Aquatic Living Resources,* **18,** 261-273.

Schiller, A., Hunsaker, C.T., Kane, M.A., Wolfe, A.K., Dale, V.H., Suter, G.W., Russell, C.S., Pion, G., Jensen, M.H. & Konar, V.C. (2001) Communicating ecological indicators to decision makers and the public. *Conservation Ecology,* **5,** 19.

Schramm, H.L., Armstrong, M.L., Funicelli, N.A., Green, D.M., Lee, D.P., Manns, R.E., Taubert, B.E. & Waters, S.J. (1991) The status of competitive sport fishing in North America. *Fisheries,* **16,** 4-12.

Schuhmann, P. & Schwabe, K. (2004) An analysis of congestion measures and heterogenous angler preferences in a random utility model or recreational fishing. *Environmental and Resource Economics,* **27,** 429-450.

Scott, D. & Shafer, S.C. (2001) Recreational Specialization: A critical look at the construct. *Journal of Leisure Research,* **33,** 319-343.

Skomal, G.B. (2007) Evaluating the physiological and physical consequences on capture on post-release survivorship in large pelagic fishes. *Fisheries Management and Ecology,* **14,** 81-89.

Slovic, P. (1979) Perception of risk. *Science,* **236,** 280-285.

Smith, H.D. (2000) The industrialisation of the world ocean. *Ocean and Coastal Management,* **43,** 11-28.

Smith, J.T. (1993) Charter fishing for tuna in Tasmania. *Recreational Fishing Report No1.* Department of Primary Industries and Fisheries, Tasmania. No. 28 pp.

Sneath, P.A. & Sokal, R.R. (1973) *Numerical Taxonomy,* San Fransisco: Freeman. No 573pp.

Spencer, P.D. (1993) Factors influencing satisfaction of anglers on Lake Miltona, Minnesota. *North American Journal of Fisheries Management,* **13,** 201-209.

Stebbins, R.A. (1992) *Amateurs, Professionals and Serious Leisure.* Montreal: McGill-Queen's University Press.

Stitt, C. (2004) The influence of social norms on attitudes: considering a modified value-expectancy approach. Paper presented at the annual meeting of the International Communication Association. New Orleans, LA.

Stern, P.C., Dietz, T., Kalof, L. & Guagnano, G.A. (1995) Values, beliefs and pro-environmental action: Attitude formation toward emergent attitude objects. *Journal of Applied Social Psychology,* **26.**

Sutton, S. (2001) Understanding catch and release behavior of recreational anglers. Doctoral Dissertation, College Station, TX. Texas A&M University.

Sutton, S. & Ditton, R.B. (2001) Understanding catch and release behaviour among US Atlantic bluefin tuna anglers. *Human Dimensions of Wildlife,* **6,** 49-66.

Sutton, S.G. (2003) Personal and situational determinants of catch and release choice of freshwater anglers. *Human Dimensions of Wildlife,* **8,** 109-126.

Tabachnick, B.G. & Fidell, L.S. (2007) *Using Multivariate Statistics,* Boston: Pearson Education.

Tallis, H., Levis, P.S., Ruckelshaus, M., Lester, S.E., McLeod, K.L., Fluharty, D. & Halpern, B.S. (2010) The many faces of ecosystem-based management: Making the process work today in real places *Marine Policy,* **34,** 340-348.

Tarrant, M.A. & Green, G.T. (1999) Outdoor recreation and the predictive validity of environmental attitudes. *Leisure Sciences,* **21,** 17-30.

Thomas, A. & Vogelsong, H. (2003) The social benefits of saltwater recreational fishing. *Proceedings of the 2003 Northeast Recreation Research Symposium.*

Unrah, D.R. (1979) Characteristics and types of participation in social worlds. *Symbolic Interaction,* **2,** 115-130.

Unrah, D.R. (1980) The nature of social worlds. *Pacific Sociological Review,* **23,** 271-296.

Vigliano, P.H., Lippolt, G., Denegri, A., Alonso, M., Macchi, P. & Dye, C.O. (2000) The human factors of the sport and recreational fishery of San Carlos de Bariloche, Rio Negro, Argentina. *Fisheries Research,* **49,** 141-153.

Virden, R.J. & Schreyer, R. (1988) Recreation specialization an an indicator of environmental preference. *Environment and Behaviour,* **20,** 721-739.

Wallmo, K. & Gentner, B. (2008) Catch and release fishing: A comparison of intended and actual behaviour of marine anglers. *North American Journal of Fisheries Management,* **28,** 1459-1471.

Wheeler, S. & Damania, R. (2001) Valuing New Zealand recreational fishing and an assessment of the contingent valuation estimates. *The Australian Journal of Agricultural and Resource Economics,* **45,** 599-621.

Wilde, G.R. & Reichers, R.K. (1994) Demographic and social characteristics and management preferences of Texas freshwater catfish anglers *Proceedings of the South-eastern Association Fish and Wildlife Agencies.*

Wilde, G.R., Riechers, R. & Ditton, R.B. (1998) Differences in attitudes, fishing motives, and demographic characteristics between tournament

and non-tournament black bass anglers in Texas. *North American Journal of Fisheries Management,* **18,** 422-431

Woodward, R.T. & Griffin, W.L. (2003) Size and bag limits in recreational fisheries: theoretical and empirical analysis *Marine Resource Economics,* **18,** 239-262.

Wright, M., V & Sanyal, N. (1998) Differentiating motivations of guided versus unguided fly anglers. *Human Dimensions of Wildlife,* **3,** 34-46.

Appendix I: Private Boat Fisher's Questionnaire

FISHING SURVEY

Day, Month, 2006

Dear boat owner:

You are invited to participate in a survey on saltwater boating and fishing in Tasmania. The survey is designed to gather valuable information for both MAST **and** a separate study that is being conducted on saltwater gamefishing (fishing for tuna, marlin and oceanic sharks) in Tasmania. So, if you have been saltwater fishing in Tasmania over the past 12 months, please keep reading!

Information from people who haven't been gamefishing, but have been involved in other forms of saltwater fishing in Tasmania, will also be valuable to us. Therefore, we urge you to complete this questionnaire whether you went gamefishing over the past 12 months or not. We understand that your time is valuable and have tried to make the questionnaire easy to follow and complete, while still being detailed enough to address the aims of our research. Further information about the survey and how you could win great prizes from Stormy Australia and Spot On Fishing Tackle, is explained below.

Who is conducting this research?

This survey is being conducted for MAST and as part of a PhD project on the social and economic importance of gamefishing in Tasmania. The PhD Project is jointly funded by the University of Tasmania and the Marine Resources Division of the Department of Primary Industry and Water (DPIW). Sven Frijlink is the PhD student involved, and his supervisor is Dr Elaine Stratford.

What is the purpose of this research and how will it benefit you?

MAST will be able to use the information to better understand boat use plus anglers attitudes to boating facilities and boating safety.

The purpose of the gamefishing study is to learn about the economic and social importance of game fishing to Tasmanian anglers and to Tasmanian coastal communities. The study is designed to gain a greater understanding of the social and cultural role that gamefishing plays in Tasmania and its contribution to regional economic activity and tourism. This type of information may be used to:

- Protect the interests of gamefishers in management decisions and policy formulation
- Strengthen the position of recreational fishers and their access to gamefish stocks

If I choose to participate, what should I do?

If you choose to complete the questionnaire, it should take about 10-15 minutes, depending on how much detail you choose to write. Please complete the questionnaire as soon as convenient as some of the questions ask you to recall details that may be difficult to remember. When completed, simply send the questionnaire back to us in the pre-paid, self-addressed envelope provided. The quality of the data that we collect depends on the number of completed questionnaires that are returned to us.

Tasmania
DEPARTMENT of PRIMARY INDUSTRIES, WATER and ENVIRONMENT

Not without my STORMY
Personal Flotation Device

Tasmania

Spot On Fishing Tackle
'It's Spot On'

UTAS
FACULTY OF SCIENCE, ENGINEERING & TECHNOLOGY
School of Geography & Environmental Studies

How can I enter the 'Lucky Questionnaire' competition?

If you would like to enter the *Lucky Questionnaire Competition*, you will need to provide a phone number in the space provided at the end of the questionnaire (page 6). The first prize is a PFD-1 inflatable vest (RRP $315) from Stormy Australia and the second prize is a $150 gift voucher from Spot On Fishing Tackle. The winners will be randomly drawn from all completed questionnaires returned to us by Friday 20th October, 2006.

How private is the information that I give?

You were selected from the MAST boat registration database to participate in this study based on the size and type of your boat. Sven and Elaine have not been given access to this database, as this survey has been sent directly through MAST.

Each questionnaire has a unique serial code printed on the front page. This code will help MAST identify non-respondents so a reminder letter may be sent. When questionnaires are returned to us, the code will be removed. The results of this survey will be reported in group form. Therefore, you cannot be identified as a participant. The completed questionnaires will be kept in a secured location for five years, and then destroyed. The data collected will not be made available for marketing or promotional purposes

Who can I contact if I have questions?

If you would like to contact us about the questionnaire or about the study in general, please contact Sven Frijlink using the contact details provided below. This research has been approved by the Human Research Ethics Committee (Tasmania) Network. If you have any concerns or complaints about how the study is being conducted, please call the Executive Officer of the Network, Ph (03) 6226 2763.

Am I able to find out the results of the Gamefishing Study?

Yes. You may obtain a summary of the results by calling Sven Frijlink on the number listed below.

Thank you kindly for your help!

Sincerely,

Colin Finch
MAST Chief Executive
Level 1
7-9 Franklin Wharf
Hobart 7001

Elaine Stratford
Chief Investigator
University of Tasmania
Private Bag 78
Hobart 7001
Ph. 6226 2462

Sven Frijlink
Investigator
University of Tasmania
Private Bag 78
Hobart 7001
Ph. 6265 7310

ECTION A: GENERAL FISHING INFORMATION

1. Over the last 12 months, how many separate days have ou spent fishing in Tasmania in...

Saltwater, from a private boat (including your own boat/s).....		days
Saltwater, from a charter boat.....		days
Saltwater, from the shore, pier or other structure.....		days
Freshwater.....		days

Q2. Of the days you spent fishing from a private boat (including your own boat/s) over the last 12 months in Tasmania, on how many separate days did you spend doing the following fishing activities?

Estuary fishing.....		days
Bay fishing.....		days
Gamefishing (eg tuna, sharks..)		days
Offshore bottom fishing.....		days
Crayfishing using pots.....		days
Other non-line fishing ie net fishing, diving, spearfishing....		days
Freshwater fishing.....		days
other, _____		days

3. Compared to other anglers, how do you rate your eneral angling abilities?

- Less skilled..... ☐
- Equally skilled ..... ☐
- More skilled..... ☐

Q4. Compared to other types of outdoor activites you participate in, would you say fishing is...

- Your most important outdoor activity ☐
- Your second most important outdoor activity ☐
- Your third most important outdoor activity ☐
- Only one of many outdoor activities that I do ☐

ECTION B: FISHING EXPENDITURE

1. Please indicate how much money you have spent on the following fishing-related expenses over the last 12 months. ease also indicate what PERCENTAGE of this cost is directly related to Tasmanian saltwater gamefishing (offshore shing for tuna, sharks and marlin), if any.

	All Fishing	% for Gamefishing
Fishing tackle purchases	$	%
Fishing tackle maintenance	$	%
Bait, berley and ice	$	%
Fishing books and magazines	$	%
Fishing club fees	$	%
Fishing competition fees	$	%
Fishing licence fees	$	%

2. The following is a list of goods and services that may be purchased for fishing related purposes. However, money pent on them can also serve purposes other than for fishing. Please estimate how much money you have spent on ach item in the last 12 months that is related to ANY Tasmanian fishing activity. Of this amount, please estimate the ERCENTAGE of this cost that is directly related to gamefishing in Tasmania, if any.

	All Fishing	% for Gamefishing
Special clothing (eg wet weather gear, boat shoes)	$	%
Safety gear (eg life jackets)	$	%
Boat and/or trailer purchases	$	%
Boat/trailer insurance	$	%
Boat/trailer registration fees	$	%
Boat charter fees	$	%
Boat fuel and oil	$	%
Boat fittings and/or modifications	$	%
Boat hire	$	%
Boat/trailer maintenance	$	%
Camping gear purchases and maintenance	$	%
Chemist supplies (eg sunscreen, seasick pills)	$	%
Vehicle hire charges	$	%
Accommodation	$	%
Airfares	$	%
Other, _____	$	%

ECTION C: DEMOGRAPHIC INFORMATION.

his section is designed to help us learn more about Tasmanian fishers. The information you provide will remain onfidential and will not be made available for commercial or marketing interests.

1. What is your age? ☐ years

C2. What is your gender? ☐ M ☐ F

3. Which one of the following best describes your IGHEST level of education completed?

- ☐ Junior (<15 years)
- ☐ Junior High (>15 years)
- ☐ HSC/ Matriculation
- ☐ Trade Qualification
- ☐ Diploma
- ☐ Degree

C4. Which one of the following best descibes your current employment status?

- ☐ Full-time employed
- ☐ Part-time employed
- ☐ Casually-employed
- ☐ Self-employed
- ☐ Student
- ☐ Unemployed
- ☐ Retired
- ☐ Non-retirement pensioner

5. What is your approximate annual income in Australian dollars before tax?

- ☐ Under $20,000
- ☐ $20,000 - $29,999
- ☐ $30,000 - $39,999
- ☐ $40,000 - $49,999
- ☐ $50,000 - $59,999
- ☐ $60,000 - $69,999
- ☐ $70,000 - $79,999
- ☐ $80,000 - $89,999
- ☐ $90,000 - $100,000
- ☐ Over $100,000

6. Are you a member of a fishing club or association?

☐ No ☐ Yes → Which one/s, _____

C7. What is the postcode of your current home address?

☐

F YOU ANSWERED THAT YOU WENT GAMEFISHING IN TASMANIA OVER THE LAST 12 MONTHS FOR QUESTION A2, LEASE CONTINUE TO SECTION D, BELOW. IF YOU DID NOT GO GAMEFISHING OVER THE LAST 12 MONTHS, LEASE SKIP TO SECTION I ON PAGE 6.

ECTION D: GAMEFISHING PARTICIPATION

1. How many years have you been involved in amefishing off...

Tasmania	☐	years
Other Australian states	☐	years
Overseas	☐	years

D2. Compared to other gamefishers, how do you rate your gamefishing abilities?

- ☐ Less skilled
- ☐ Equally skilled
- ☐ More skilled

3. Eight species of gamefish are listed below. Please dicate if you have *ever* caught that species in waters off asmania, by placing a tick in the YES or NO box. From the pecies you marked YES, please rank them in the order that ou PREFER to catch, with 1 being the most preferred, 2 the econd most preferred and so on...

	NO	YES	RANK
Striped marlin.....	☐	☐	☐
Yellowfin tuna.....	☐	☐	☐
Bluefin tuna.....	☐	☐	☐
Albacore tuna.....	☐	☐	☐
Bigeye tuna.....	☐	☐	☐
Striped tuna.....	☐	☐	☐
Yellowtail kingfish..	☐	☐	☐
Mako shark.....	☐	☐	☐
Blue shark.....	☐	☐	☐

D4. If you were no longer permitted to fish for your MOST PREFERRED SPECIES in waters off Tasmania (due to a population decline in that species), would you.....

(PLEASE MARK ONE ONLY)

- ☐ Go gamefishing for a different species in Tasmania
- ☐ Go gamefishing for a different species elsewhere (interstate or overseas)
- ☐ Go gamefishing for your most preferred species elsewhere (interstate or overseas)
- ☐ Give up gamefishing and fish for non-gamefish species
- ☐ Give up gamefishing and do some non-fishing activity
- ☐ Other, _____

5. When gamefishing in waters off Tasmania, what is the elative percentage of your time spent fishing for the llowing types of gamefish?

LL PERCENTAGES HOULD ADD UP TO 0%)

Tuna.....	☐	%
Shark	☐	%
Marlin.....	☐	%
Other.....	☐	%
	100	%

D6. Compared to other types of fishing you participate in, would you say gamefishing is.....

- ☐ The *only* type of fishing that you do
- ☐ Your most important type of fishing
- ☐ Your second most important type of fishing
- ☐ Only one of many types of fishing that you do

SECTION D: Continued

7. When gamefishing, who do you fish with?

OR EACH OF THE OLLOWING PEOPLE, PLEASE CK HOW OFTEN YOU FISH ITH THEM)

	Always	Often	Sometimes	Never
By yourself	☐	☐	☐	☐
With friends	☐	☐	☐	☐
With family	☐	☐	☐	☐
With family and friends together	☐	☐	☐	☐
With members of a fishing club	☐	☐	☐	☐
With others, _____	☐	☐	☐	☐

8. Below is a list of general reasons why people o fishing. For each category, please place a tick n the box to rate the importance of your reasons or GAMEFISHING

	Extremely important	Very important	Moderately important	Slightly important	Not at all important
To be outdoors	☐	☐	☐	☐	☐
For family recreation	☐	☐	☐	☐	☐
For relaxation	☐	☐	☐	☐	☐
To experience new and different things	☐	☐	☐	☐	☐
To be close to the water	☐	☐	☐	☐	☐
To obtain fish to eat	☐	☐	☐	☐	☐
For the experience of catching fish	☐	☐	☐	☐	☐
To get away from the demands of other people	☐	☐	☐	☐	☐
To be with friends	☐	☐	☐	☐	☐
To experience unpolluted natural surroundings	☐	☐	☐	☐	☐
To develop fishing skills	☐	☐	☐	☐	☐
To test my fishing gear	☐	☐	☐	☐	☐
To get away from the regular routine	☐	☐	☐	☐	☐
To catch a 'trophy' fish	☐	☐	☐	☐	☐
For challenge or sport	☐	☐	☐	☐	☐
To experience adventure and excitement	☐	☐	☐	☐	☐
To fish where it is not difficult to catch fish	☐	☐	☐	☐	☐
To participate in competition	☐	☐	☐	☐	☐
To participate in catch and release fishing	☐	☐	☐	☐	☐
Because of reports of good fish availability	☐	☐	☐	☐	☐
Because of reports of good weather conditions	☐	☐	☐	☐	☐

9. The following is a list of statements about shing. For each statement, please place a tick n the box that best describes your level of greement or disagreement in relation to AMEFISHING.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Unsure
The more fish I catch the happier I am	☐	☐	☐	☐	☐	☐
A fishing trip can be successful even if no fish are caught	☐	☐	☐	☐	☐	☐
I usually eat the fish I catch	☐	☐	☐	☐	☐	☐
A successful fishing trip is one in which many fish are caught	☐	☐	☐	☐	☐	☐
I would rather catch 1 or 2 big fish than 10 smaller fish	☐	☐	☐	☐	☐	☐
I'm just as happy if I don't catch a fish	☐	☐	☐	☐	☐	☐
It doesn't matter to me what type of fish I catch	☐	☐	☐	☐	☐	☐
The bigger the fish that I catch, the better the fishing trip	☐	☐	☐	☐	☐	☐
I'm just as happy if I release the fish I catch	☐	☐	☐	☐	☐	☐
I want to keep all the fish I catch	☐	☐	☐	☐	☐	☐
I'm happiest when I catch a challenging fish	☐	☐	☐	☐	☐	☐
If I thought I would not catch fish I would not go fishing	☐	☐	☐	☐	☐	☐
I like to fish where I know I may catch a trophy fish	☐	☐	☐	☐	☐	☐
I'm not satisfied unless I catch at least something	☐	☐	☐	☐	☐	☐

SECTION E: GAMEFISHING TRIP EXPENDITURE AND TRIP DETAILS

A separate column is provided for each main gamefishing region in Tasmania. If you did not go gamefishing in that region, please ignore. If you did gamefish in that region, please try to recall details as accurately as possible.

	ST HELENS	TASMAN PENINSULA	DOVER/SOUTHPORT	OTHER REGION/S Please specify, _____
E1. How many separate gamefishing trips did you make during each month in 2006?	January ☐ April ☐ February ☐ May ☐ March ☐ June ☐	January ☐ April ☐ February ☐ May ☐ March ☐ June ☐	January ☐ April ☐ February ☐ May ☐ March ☐ June ☐	January ☐ April ☐ February ☐ May ☐ March ☐ June ☐
E2. How many of these trips were made in your own boat, a friends boat or charter boat?	your boat ☐ friends boat ☐ charter ☐	your boat ☐ friends boat ☐ charter ☐	your boat ☐ friends boat ☐ charter ☐	your boat ☐ friends boat ☐ charter ☐
E3. Overall, how many nights did you spend in each region on your gamefishing trip/s?	☐ nights	☐ nights	☐ nights	☐ nights
E4. On average, how many gamefishing and non-gamefishing people came with you on each gamefishing trip?	Fishing ☐ Non-gamefishing ☐	Fishing ☐ Non-gamefishing ☐	Fishing ☐ Non-gamefishing ☐	Fishing ☐ Non-gamefishing ☐

E5. How much did YOU personally spend on your gamefishing trips over the 2006 season? Please only write down expenses that were made WITHIN each region AND due to the gamefishing trip/s. If gamefishing was the only reason or main reason for visiting the region, please record all expenses made in that region.

	ST HELENS	TASMAN PENINSULA	DOVER/SOUTHPORT	OTHER REGION/S
Accommodation	$ ☐	$ ☐	$ ☐	$ ☐
Restaurants/ café purchases	$ ☐	$ ☐	$ ☐	$ ☐
Food and soft drink	$ ☐	$ ☐	$ ☐	$ ☐
Entertainment	$ ☐	$ ☐	$ ☐	$ ☐
Alcohol	$ ☐	$ ☐	$ ☐	$ ☐
Vehicle fuel	$ ☐	$ ☐	$ ☐	$ ☐
Fishing tournament entry fees	$ ☐	$ ☐	$ ☐	$ ☐
Fishing gear, bait, berley, ice	$ ☐	$ ☐	$ ☐	$ ☐
Boat fuel	$ ☐	$ ☐	$ ☐	$ ☐
Boat mooring/storage	$ ☐	$ ☐	$ ☐	$ ☐
Boat repairs/maintenance	$ ☐	$ ☐	$ ☐	$ ☐
Charter fees	$ ☐	$ ☐	$ ☐	$ ☐
Other, _____	$ ☐	$ ☐	$ ☐	$ ☐

E6. How many of the following gamefish did YOU personally bring to the boat during the season? Of these fish, how many were released?

	ST HELENS		TASMAN PENINSULA		DOVER/SOUTHPORT		OTHER REGION/S	
	brought to boat	released	brought to boat	released	brought to boat	released	brought to boat	released
Albacore tuna	☐	☐	☐	☐	☐	☐	☐	☐
Striped tuna	☐	☐	☐	☐	☐	☐	☐	☐
Bigeye tuna	☐	☐	☐	☐	☐	☐	☐	☐
Yellowfin tuna	☐	☐	☐	☐	☐	☐	☐	☐
Southern bluefin tuna	☐	☐	☐	☐	☐	☐	☐	☐
Striped marlin	☐	☐	☐	☐	☐	☐	☐	☐
Yellowtail kingfish	☐	☐	☐	☐	☐	☐	☐	☐
Mako shark	☐	☐	☐	☐	☐	☐	☐	☐
Blue shark	☐	☐	☐	☐	☐	☐	☐	☐

ECTION F: GAMEFISHING ACTIVITY VALUATION

1. Consider the amount of money you have spent on your gamefishing trips during the 2006 season (Section E). ow much MORE money would you be prepared to spend on your Tasmanian gamefishing trips per season before ou would decide to stop gamefishing?

$ ☐

If you answered $0, please choose the statement that best describes your reason

- ☐ You object to these kind of questions
- ☐ You feel that you currently pay enough and you would not be prepared to pay more
- ☐ You cannot afford to pay more

ECTION G: BOAT OWNERSHIP AND USE

1. If you go gamefishing in your own boat;

a) How old is your boat? ☐ years
b) How many years have you owned it? ☐ years
c) How much did you pay for it? $ ☐

G2. If you purchased your boat trailer seperately;

a) How old is the trailer? ☐ years
b) How much did it cost? $ ☐

3. If you have purchased additional electronic equipment, ttings or modifications for your boat;

a) Roughly how old are they? ☐ years
b) How much did it/they cost? $ ☐

G4. How many days have you used your boat for ALL activities (including gamefishing) over the last 12 months?

☐ days

ECTION H: ATTITUDES TO GAMEFISHING MANAGEMENT AND FACILITIES

1. The following is a list of management options for the asmanian recreational gamefishery. None of these options re currently being implemented; however, we would like to nderstand how anglers feel about them. Please indicate your vel of agreement or disagreement with each of the following.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Unsure
Southern bluefin tuna to be catch and release only	☐	☐	☐	☐	☐	☐
Striped marlin to be catch and release only	☐	☐	☐	☐	☐	☐
A personal combined bag limit of 1 bluefin or yellowfin tuna	☐	☐	☐	☐	☐	☐
A personal combined bag limit of 1 mako shark or blue shark	☐	☐	☐	☐	☐	☐
Gamefish possesion limits for boats	☐	☐	☐	☐	☐	☐
A personal bag limit of 5 albacore	☐	☐	☐	☐	☐	☐
The introduction of saltwater angling licences	☐	☐	☐	☐	☐	☐
The encouragement of catch and release fishing	☐	☐	☐	☐	☐	☐
The encouragement of tag and release fishing	☐	☐	☐	☐	☐	☐
A minimum size limit for albacore tuna	☐	☐	☐	☐	☐	☐

2. Overall, how satisfied are you with the quality of gamefishing in Tasmania?

☐ Not at all satisfied ☐ Moderately satisfied ☐ Very satisfied ☐ Extremely satisfied

3. What do you think is the most important issue facing the recreational gamefishery in Tasmania?

SECTION I: BOAT RAMPS, JETTIES AND BOATING FACILITIES

1. Do you think that boat ramps, jetties and other fishing and boating facilities in Tasmanina coastal areas are adequate? If not, please let us know how you think these facilities could be improved.

_____

_____

_____

_____

_____

_____

_____

SECTION J: BOATING SAFETY

1. Do you carry a Personal Locator Beacon (PLB) when you go boating?

☐ No ☐ Yes

2. Do you carry any other ADDITIONAL safety gear (non-mandatory safety gear) when you go boating ?

☐ No ☐ Yes → please specify _____

_____

3. What type of EPIRB do you carry on your boat when boating?

☐ 406 ☐ 121.5

4. When boating, do you.....? (PLEASE MARK ONE ONLY)

☐ Always tell somebody when you are going and when you plan to return
☐ Sometimes tell someone
☐ Rarely tell someone
☐ Never tell someone

5. What is your single most common source of obtaining the weather forecast before boating?

(PLEASE MARK ONE ONLY)

☐ TV
☐ Newspaper
☐ Marine Radio
☐ MAST Telephone service
☐ Other telephone service
☐ Internet
☐ Weather fax
☐ AM/FM radio
☐ Other, _____
☐ Do NOT check weather

Your contribution to this study is greatly appreciated! Please return your completed questionnaire in the postage paid envelope.

If you would like to enter the *Lucky Questionnaire Competition* to win an inflatable PFD-1 vest from Stormy Australia, or a $150 gift voucher from Spot On Fishing Tackle, place a tick in the Yes or NO box below, and leave your daytime phone number in the space provided at the bottom of the page.

☐ YES ☐ NO

2007 PHONE SURVEY

We will be running another gamefishing survey over the course of the 2007 Tasmanian gamefishing season (January - June). This survey will be a phone survey where participants will be contacted by telephone each month and asked details about their gamefishing trip/s. Details include the amount of time spent fishing, catch information and money spent. This type of information will give us a deeper understanding of the importance of the fishery to different regions, and at different times of the year. A $500 gift voucher from Spot On Fishing Tackle will also be awarded to one lucky volunteer. If you would like to participate in the phone survey, please indicate by placing a tick in either the YES or NO box below, plus your phone number. If you tick YES, we will contact you before the 2007 gamefishing season and provide you with more details.

☐ YES ☐ NO

PHONE NUMBER ☐

Appendix II: Charter Boat Fisher's Questionnaire

Your response is important

Tasmanian Charterboat Gamefishing Survey 2007

Win a $1000 fishing tackle voucher!

UTAS
FACULTY OF SCIENCE, ENGINEERING & TECHNOLOGY
School of Geography & Environmental Studies

Spot On Fishing Tackle

Tasmania
Explore the possibilities

Tasmanian Charterboat Gamefishing Survey 2007

SURVEY INFORMATION SHEET

Dear Angler:

You are invited to participate in a survey of the game-charter fishery in Tasmania. The survey is part of a larger study examining the social and economic importance of gamefishing to anglers and coastal communities in Tasmania. This part of the study is a questionnaire designed to be completed by charter boat customers who have been angling for gamefish. In this questionnaire, you will be asked to provide details about your charter boat gamefishing trip plus your gamefishing activity in general. We understand that your time is valuable and have tried to make the questionnaire easy to follow and complete, while still being detailed enough to address the aims of this research.

Who is conducting this research?

This research is being undertaken as part of a PhD research project. The Project is jointly funded by the School of Geography and Environmental Studies at the University of Tasmania and the Marine Resources Division of the Department of Primary Industry and Water (DPIW).

What is the purpose of this research and how will it benefit you?

The purpose of this study is to learn about the economic and social importance of game and charter fishing to Tasmanian anglers and coastal communities. We aim to gain a greater understanding of the human side of the game fishery, the social and cultural role it plays in Tasmania, and its contribution to regional economic activity and tourism. This type of information may be used to:

- Protect the interests of gamefishers in management decisions and policy formulation
- Strengthen the position of recreational fishers and their access to gamefish stocks

What do you need to do if you choose to participate?

If you choose to complete the questionnaire (and you haven't already completed one during this season), it should take about 10-15 minutes. Please complete the questionnaire as soon as convenient after your charter boat fishing trip. If your trip involves more than one days' fishing, please complete it after your last day. As some of the questions relate to specific details of your charter fishing trip, they may be difficult to remember if left for a long time. When completed, simply send the questionnaire back to us in the pre-paid, self-addressed envelope provided.

How can you enter the 'Lucky Questionnaire' competition?

If you would like to go into the draw to win a $1000 fishing tackle voucher from *Spot On* Fishing Tackle, you will need to provide a phone number in the space provided at the end of the questionnaire. The winner will be randomly drawn by an independent person from all questionnaires returned by Friday, 13 July, 2007. The winner will be notified that day.

Tasmanian Charterboat Gamefishing Survey 2007

How private is the information that you give?

Because this survey is anonymous, you will not be associated with your answers. We do not require your name or address - only a phone number for the sole purpose of entering the 'Lucky Questionnaire' competition. Also, data will not be made available for marketing or promotional purposes. The results of this survey will be reported as a group, so individual responses will not be identified. The completed questionnaires will be kept in a secured location for five years, and then destroyed.

Who can you contact if you have questions?

If you would like to contact us about the questionnaire or about the study in general, please contact Sven Frijlink on the contact details provided below. This research has been approved by the Human Research Ethics Committee (Tasmania) Network. If you have any concerns or complaints about how the study is being conducted, please call the Executive Officer of the Network on (03) 6226 2763.

Are you able to find out the results of the research?

Yes. A summary of the results of this research will be provided when available by calling Sven Frijlink on the number listed below.

Thank you kindly for your help!

Sincerely,

Dr. Elaine Stratford
Chief Investigator
University of Tasmania
Private Bag 78
Hobart 7001
Ph. (03) 6226 2462
Email: Elaine.Stratford@utas.edu.au

Sven Frijlink
Investigator
University of Tasmania
Private Bag 78
Hobart 7001
Ph: (03) 6265 7310
Email: sfrijlin@bigpond.net.au

1. How many YEARS experience have you had recreational *angling* of ALL types? ☐ YEARS

If this is your first time angling, please go *to Question 17* ▶

2. Since this time last year, on how many separate DAYS have you been angling in...
(*DAYS includes whole or partial days, in Tasmania or anywhere else*)

...saltwater, from a private boat.....	☐ DAYS
...saltwater, from a charter boat (not including this trip).....	☐ DAYS
...saltwater, from the shore or pier.....	☐ DAYS
...freshwater.....	☐ DAYS

3. Was your recent charter boat trip your *first* ever...
(*Please place a mark in the appropriate box*)

...gamefishing trip?.....	☐ NO ▼	☐ YES (*go to Q17* ▶)
...gamefishing trip in Tasmanian waters?.....	☐ NO ▼	☐ YES (*go to Q10* ▶)
... gamefishing trip on a charter boat in Tasmanian waters?	☐ NO ▼	☐ YES (*go to Q6* ▶)

4. During your life, approximately how many days have you been gamefishing from a Tasmanian charter boat before this trip? (*Tick one box*)

☐ less than 5 ☐ 5-10 ☐ 10-15 ☐ 15-20 ☐ more than 20

5. How many days have you been gamefishing from a Tasmanian charter boat during the current gamefishing season (January–June 2007), not including this trip? ☐ DAYS

6. Eight species of gamefish are listed below. Please indicate if you have *ever* caught one or more of that species in Tasmanian waters, by placing a tick in either the YES or NO box. Please also rank the fish in the order that you would PREFER to catch, with 1 being the most preferred, 2 the second most preferred and so on....

	YES	NO	RANK	
Striped marlin.....	☐	☐	☐	CHOICE
Striped tuna.....	☐	☐	☐	CHOICE
Yellowtail kingfish.....	☐	☐	☐	CHOICE
Southern Bluefin tuna.....	☐	☐	☐	CHOICE
Mako shark.....	☐	☐	☐	CHOICE
Blue shark.....	☐	☐	☐	CHOICE
Albacore tuna.....	☐	☐	☐	CHOICE
Yellowfin tuna.....	☐	☐	☐	CHOICE

7. **If you were no longer permitted to fish for your MOST PREFERRED SPECIES in waters off Tasmania (due to a population decline of that species), would you...**(*Tick one box*)

- ☐ Go gamefishing for a different species in Tasmanian waters
- ☐ Go gamefishing for a different species elsewhere (interstate or overseas)
- ☐ Go gamefishing for your most preferred species elsewhere (interstate or overseas)
- ☐ Give up gamefishing and fish for non-gamefish species
- ☐ Give up gamefishing and do some non-gamefish activity instead
- ☐ Other, _____

8. **When gamefishing in Tasmanian waters, overall what proportion of your fishing EFFORT would you say is targeted at the following types of gamefish?** (*All percentages should add up to 100%*).

Tuna		%
Shark		%
Marlin.....		%
Other, _____		%
	100	%

9. **How many southern bluefin tuna (SBT) did you <u>personally</u> catch and keep AND catch and release in Tasmanian waters over the 2006 season?**

Number kept.....		SBT
Number released.....		SBT
Total.....		SBT

10. **Compared to other gamefishers, how do you rate your gamefishing abilities?** *(Tick one box)*

☐ Less Skilled ☐ Equally Skilled ☐ More Skilled

11. **Compared to *other* types of fishing, which of the following best describes your *gamefishing* activities.** (*Tick one box*)

The *only* type of fishing that I do.....	☐
My most important type of fishing.....	☐
My second most important type of fishing.....	☐
Only one of many types of fishing that I do.....	☐

12. **Compared to your other types of *outdoor activities*, which of the following best describes your *general* fishing activities.** (*Tick one box*)

My most important outdoor activity.....	☐
My second most important outdoor activity.....	☐
Only one of many outdoor activities that I do.....	☐

13. When GAMEFISHING in Tasmania, who do you fish with? (*Please mark the category that best describes how often you go fishing with **each** of the following people*).

	Always	Often	Sometimes	Never
By yourself	☐	☐	☐	☐
With friends	☐	☐	☐	☐
With family	☐	☐	☐	☐
With family and friends together	☐	☐	☐	☐
With members of a fishing club	☐	☐	☐	☐
With others, _____	☐	☐	☐	☐

14. When doing OTHER types of fishing, who do you fish with? (*Please mark the category that best describes how often you go fishing with **each** of the following people).*

	Always	Often	Sometimes	Never
By yourself	☐	☐	☐	☐
With friends	☐	☐	☐	☐
With family	☐	☐	☐	☐
With family and friends together	☐	☐	☐	☐
With members of a fishing club	☐	☐	☐	☐
With others, _____	☐	☐	☐	☐

15. The following is a list of statements about fishing. For each statement, Please mark the category which best describes your level of agreement or disagreement in relation to GAMEFISHING

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Unsure
The more fish I catch the happier I am	☐	☐	☐	☐	☐	☐
A fishing trip can be successful even if no fish are caught	☐	☐	☐	☐	☐	☐
I usually eat the fish I catch	☐	☐	☐	☐	☐	☐
A successful fishing trip is one in which many fish are caught	☐	☐	☐	☐	☐	☐
I would rather catch 1 or 2 big fish than 10 smaller fish	☐	☐	☐	☐	☐	☐
I'm just as happy if I don't catch a fish	☐	☐	☐	☐	☐	☐
It doesn't matter to me what type of fish I catch	☐	☐	☐	☐	☐	☐
The bigger the fish that I catch, the better the fishing trip	☐	☐	☐	☐	☐	☐
I'm just as happy if I release the fish I catch	☐	☐	☐	☐	☐	☐
I want to keep all the fish I catch	☐	☐	☐	☐	☐	☐
I'm happiest when I catch a challenging fish	☐	☐	☐	☐	☐	☐
If I thought I would not catch fish I would not go fishing	☐	☐	☐	☐	☐	☐
I like to fish where I know I may catch a trophy fish	☐	☐	☐	☐	☐	☐
I'm not satisfied unless I catch at least something	☐	☐	☐	☐	☐	☐

16. Below is a list of general reasons why people go fishing. For each category, please place a tick in the box to rate the importance of your reasons for GAMEFISHING

	Extremely important	Very important	Moderately Important	Slightly important	Not at all important	Unsure
To be outdoors	☐	☐	☐	☐	☐	☐
For family recreation	☐	☐	☐	☐	☐	☐
For relaxation	☐	☐	☐	☐	☐	☐
To experience new and different things	☐	☐	☐	☐	☐	☐
To be close to the water	☐	☐	☐	☐	☐	☐
To obtain fish to eat	☐	☐	☐	☐	☐	☐
For the experience of catching fish	☐	☐	☐	☐	☐	☐
To get away from the demands of other people	☐	☐	☐	☐	☐	☐
To be with friends	☐	☐	☐	☐	☐	☐
To experience unpolluted natural surroundings	☐	☐	☐	☐	☐	☐
To develop fishing skills	☐	☐	☐	☐	☐	☐
To test my fishing gear	☐	☐	☐	☐	☐	☐
To get away from the regular routine	☐	☐	☐	☐	☐	☐
To catch a 'trophy' fish	☐	☐	☐	☐	☐	☐
For challenge or sport	☐	☐	☐	☐	☐	☐
To experience adventure and excitement	☐	☐	☐	☐	☐	☐
To fish where it is not difficult to catch fish	☐	☐	☐	☐	☐	☐
To participate in competition	☐	☐	☐	☐	☐	☐
Because of reports of good fish availability	☐	☐	☐	☐	☐	☐
Because of reports of good weather conditions	☐	☐	☐	☐	☐	☐

QUESTIONS 17-29 ASK SPECIFIC INFORMATION ABOUT YOUR RECENT CHARTER BOAT GAMEFISHING TRIP. PLEASE TRY TO RECALL INFORMATION AS ACCURATELY AS POSSIBLE.

17. On the day you were given this questionnaire, how many of the following gamefish species did *you* catch, if any? Of these fish caught, how many were released?

	caught	released
Albacore tuna		
Striped tuna		
Bigeye tuna		
Yellowfin tuna		
Southern bluefin tuna		

	caught	released
Yellowtail kingfish		
Striped marlin		
Mako shark		
Blue shark		
Other, _____		

18. How many hours did you spend gamefishing that day? ☐ HOURS

19. Please indicate if you also spent time doing any of the following activities on your charter trip (*Please mark **all** that apply*).

☐ Wildlife/scenic viewing ☐ Diving ☐ Bay fishing ☐ Reef fishing ☐ Deep sea fishing

20. On what date did you go charter boat fishing when you were given this questionnaire? ...../...../ 2006

21. On how many days did you go charter boat gamefishing on this trip to St Helens? ☐ DAYS

22. How many other people travelled with you to St Helens on this trip? ☐ PEOPLE

23. How many people who travelled with you also went fishing with you on the charter boat? ☐ PEOPLE

24. Did your trip involve any overnight stays away from your usual residence?

☐ Yes▼ ☐ No (*go to Q25* ►)

24a. How many nights did you stay in the St Helens area (within 40km of St Helens)?

☐ NIGHTS (*If you indicated 0 nights, go to **Q24b*** ►)

How much was <u>your</u> share of the total accommodation cost in the St Helens area? (*the money may have been spent by you OR somebody else, but we only need to know YOUR share*) $ ☐

Of this amount, what percentage do you think was due to your involvement in the gamefishing charter trip? ☐ %

24b. How many nights did you stay in other areas of Tasmania (outside 40 km of St Helens)? ☐ NIGHTS

25. In making your decision to visit St Helens, how important was the opportunity to go gamefishing on a charter boat? *(Tick one box)*

☐ very important ☐ moderately important ☐ slightly important ☐ not at all important

26. How much money did you PERSONALLY spend on the following gamefishing related items on the day/s of your charter trip? (This includes money you may have spent for others on the trip). Please also tell us how many people your expenditure paid for and what percentage of this cost was made within 40km of St Helens.

Type of Expenditure	Amount ($)	Number of People You Paid For (including yourself)	% within 40km of St Helens
Fishing Tackle	$ _____.00		%
Bait and Berley	$ _____.00		%
Ice	$ _____.00		%
Other, _____	$ _____.00		%

26a. What percentage of these expenses would you say was due to gamefishing? ☐ %

27. Did you travel more than 40km from your usual place of residence to go to St Helens?

☐No *(go to Q29▼)* ☐Yes ► Did you use your own car to get there? ☐Yes ☐No

28. How much money did you PERSONALLY spend on the following items on the day/s of your charter trip? This includes money you may have spent for others on the trip. Please also tell us how many people your expenditure paid for and what percentage of this cost was made within 40km of St Helens.

Type of Expenditure	Amount ($)	Number of People You Paid For (Including Yourself)	% Within 40km of St Helens
Eat-in or take-away meals	$ _____.00		%
Groceries and Drinks	$ _____.00		%
Vehicle Fuel and Oil	$ _____.00		%
Other transport expenses	$ _____.00		%

28a. What percentage of these expenses would you say was due to gamefishing? ☐ %

29. How much was YOUR share of the charter boat fees for the entire trip for all days fished? *(the money may have been spent by you OR somebody else, but we need to know YOUR share only)* $ ☐

30. How satisfied were you with *this* gamefishing trip? *(Tick one box)*

☐Not at all satisfied ☐Moderately satisfied ☐Very satisfied ☐Extremely satisfied

31. How many <u>more</u> days do you think you will go gamefishing from a charter boat during the 2007 Tasmanian gamefishing season? ☐ DAYS

QUESTIONS 32-40 ARE DESIGNED TO HELP US LEARN MORE ABOUT TASMANIAN GAMEFISHING ANGLERS. THE INFORMATION YOU PROVIDE WILL REMAIN CONFIDENTIAL AND WILL NOT BE MADE AVAILABLE FOR COMMERCIAL OR MARKETING INTERESTS.

32. What is your age? ☐ YEARS **33. What is your gender?** ☐M ☐F

34. What is the postcode of your current home address? ☐

If you are not an Australian resident, please indicate which country you reside in

_____

35. Which of the following best describes your HIGHEST level of education completed?

☐Junior (< 15 years) ☐Junior High (>15 years) ☐HSC/Matriculation
☐Trade Qualification ☐Diploma ☐Degree

36. What is your approximate annual income in Australian dollars before tax?

☐Under $20,000
☐$20,000 - $29,999
☐$30,000 - $39,999
☐$40,000 - $49,999
☐$50,000 - $59,999
☐$60,000 - $69,999
☐$70,000 – $79,999
☐$80,000 – $89,999
☐$90,000 - $99,999
☐Over $100,000

37. Which of the following best describes your current employment status?

☐Full-time employed ☐Part-time Employed ☐Casually-employed
☐Self-employed ☐Student ☐Unemployed
☐Retired ☐Receive Non-Retirement Pension

38. Are you a member of a fishing club or association?

☐NO ▼ ☐YES ► Which one/s_____

39. The following are a list of management options for the Tasmanian recreational gamefishery. None of these options are currently being implemented; however, we would like to understand how anglers feel about them. Please indicate your level of agreement or disagreement with each of the following.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Unsure
Southern bluefin tuna to be catch and release only	☐	☐	☐	☐	☐	☐
Striped marlin to be catch and release only	☐	☐	☐	☐	☐	☐
A personal combined bag limit of 1 bluefin or yellowfin tuna	☐	☐	☐	☐	☐	☐
A personal combined bag limit of 1 mako shark or blue shark	☐	☐	☐	☐	☐	☐
Gamefish possesion limits for boats	☐	☐	☐	☐	☐	☐
A personal bag limit of 5 albacore	☐	☐	☐	☐	☐	☐
The encouragement of catch and release fishing	☐	☐	☐	☐	☐	☐
The encouragement of tag and release fishing	☐	☐	☐	☐	☐	☐
A minimum size limit for albacore tuna	☐	☐	☐	☐	☐	☐

40. What do you think is the most important issue facing the recreational gamefishery in Tasmania?

41. Is there anything else you would like to share with us about the questionnaire or about the Tasmanian gamefishery?

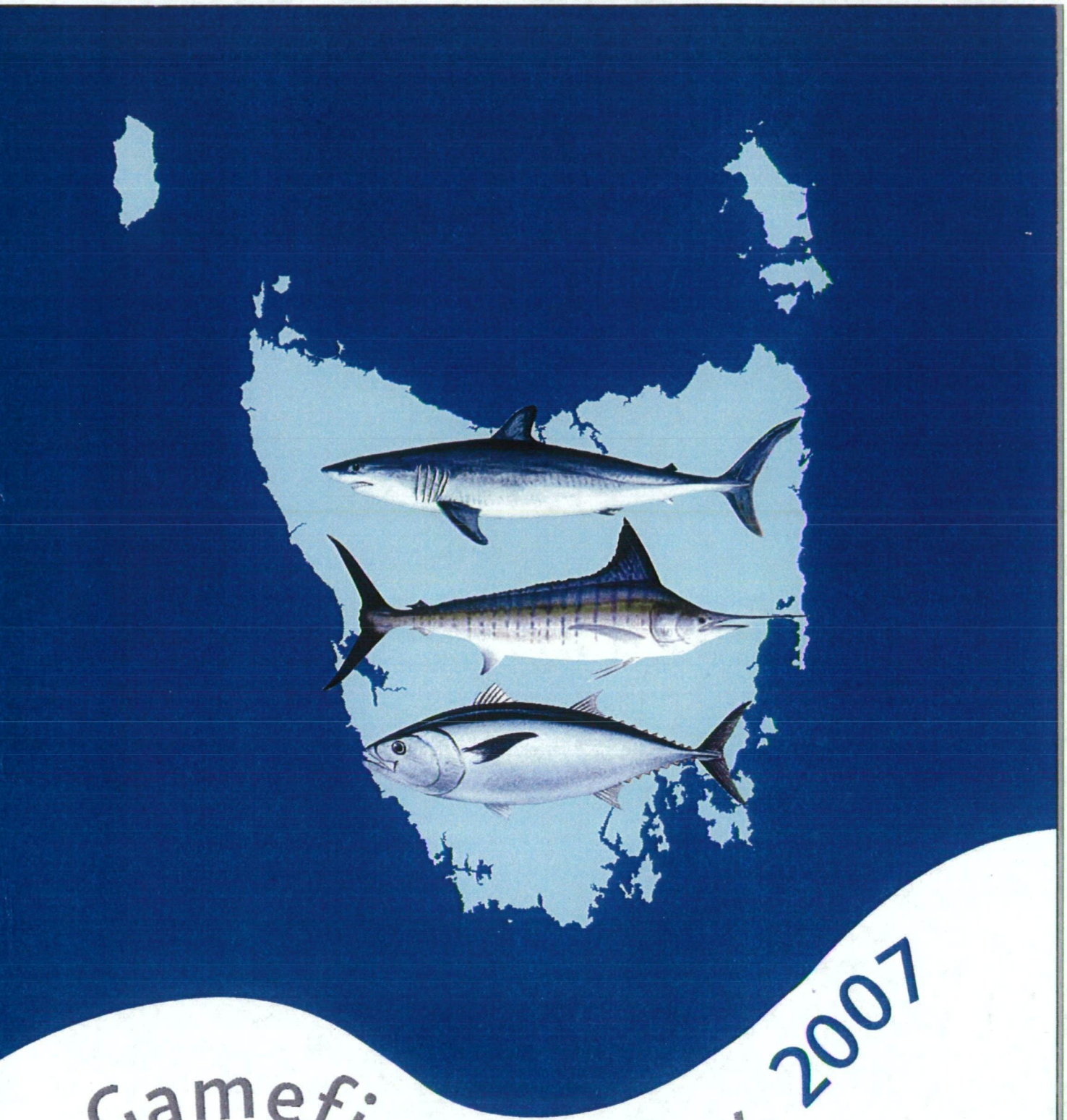
If you would like to enter the Lucky Questionnaire Competition for a $1000 voucher from Spot On Fishing Tackle, please leave you daytime phone number in the space provided.

Please indicate whether we will be able to contact you on this number if we need to clarify any of your answers. ☐YES ☐NO

Your contribution to this study is greatly appreciated. Please return your completed questionnaire in the postage paid envelope as soon as is convenient to you.

Many Thanks.

Appendix III (A): Diary for Telephone Administered Diary Survey



Gamefishing Diary 2007

UTAS
FACULTY OF SCIENCE, ENGINEERING & TECHNOLOGY
School of Geography & Environmental Studies

Tasmania
Explore the possibilities

Completing the diary

Please use this diary for all your gamefishing trips undertaken in Tasmania over the 2007 season. Complete one page **per trip**. A trip is defined as the time from when you left your usual place of residence to when you returned. Therefore, a trip for the purposes of this survey *may* include more than one day's fishing.

TRIP DETAILS

Date of Start of Trip
The date that you left your place of residence to go on a trip that included gamefishing

Date of End of Trip
The date that you returned to your place of residence from a trip that included gamefishing

Date of Day/s spent gamefishing
The number of days you spent gamefishing on your trip

Location
The place where the boat that you went gamefishing on was launched from

Number of people who travelled with you
The number of people who came with you (not including yourself) in the same vehicle on your trip to the place where the boat was launched

Number of people on boat who also participated in gamefishing
The number of people on the boat who also participated in gamefishing

Hours Gamefishing
This is number of hours that you spent time gamefishing (gear in the water)

Fishing method
Please tick the gamefishing method or methods that YOU personally used

Other Types of Fishing Done
Please indicate if you did any fishing types other than gamefishing ie reef fishing, bay fishing etc

YOUR PERSONAL CATCH

Of the fish that you personally caught, please indicate the number of fish that you kept and/or released.

BOAT CATCH

Of the catch by evey person on the boat (including yourself) please indicate how many fish were kept and/or released.

EXPENDITURE

Please record how much money YOU personally spent on the following items on the day or days of your trip. In the **region/s where expense was made column**, please specify the nearest town where the expense was made.

KILOMETRES TRAVELLED

Please estimate how many kilometres were travelled by road over the *entire* trip

If you have any questions about this survey please contact Sven Frijlink on 62 65 7310 or email sfrijlin@utas.edu.au.

TRIP DETAILS

Date of *start* of trip

Date of *end* of trip

No. of day/s spent gamefishing

Location/s

No. of people who travelled with you

No. of people on boat

No. of gamefishers on boat

Hours gamefishing

Fishing method

- ☐ Lure
- ☐ Bait
- ☐ Fly

Other type/s of fishing done

- ☐ Yes
- ☐ No

CATCH DETAILS

	Personal		Boat	
	Kept	*Released*	*Kept*	*Released*
Southern bluefin tuna				
Yellowfin tuna				
Albacore				
Mako shark				
Blue shark				
Yellowtail kingfish				
Striped marlin				
Striped tuna				
Other *(specify below)*				

PERSONAL EXPENDITURE & TRAVEL

		Total $	*Region/s where expense was made*
GAMEFISHING EXPENSES	Tackle		
	Bait		
	Berley		
	Ice		
	Competition fees		
	Other		
BOATING EXPENSES	Fuel		
	Oil		
	Maintenance/repairs		
	Other		
OTHER EXPENSES	Accommodation		
	*food and drinks		
	*vehicle fuel/oil		
	Other expenses		

* only for expenses made more than 40km from home

KILOMETRES TRAVELLED

Appendix III(B): Interview Questions for Telephone Administered Diary Survey

1. IDENTIFICATION OF DAYS/DATES

Since (START OF SURVEY PERIOD/LAST TIME WE SPOKE), **have you done any gamefishing in Tassie?**

IF NO TRIPS, GO TO PART 3

PROBE/STORE NO. OF SEPARATE TRIPS. IF NECESSARY REMIND CONTACT OF THE TRIP DEFINITION (IE PERIOD OF TIME SPENT AWAY FROM USUAL PLACE OF RESIDENCE IN WHICH GAMEFISHING WAS UNDERTAKEN)

Did you fill out your survey kit for each of these trips/days? Have you got it there?

IF YES, GO TO PART 2, BELOW
IF NO, PROCEED WITH INTERVIEW REGARDLESS, EVEN IF ONLY BASIC INFORMATION IS REMEMBERED.

2. FOR EACH TRIP (CHRONOLOGICAL ORDER; KEY PROBE: **What did you do first/next?)**

Q'tn No:

1. **So the date of (that/the first/the next) trip was....?**(RECORD START DATE AND END DATE).

   1(a). IF MORE THAN ONE DAY.....**On how many of these days did you go gamefishing?**

2. **Where did you go gamefishing from on that day/those days?** (PROBE BOAT RAMP/S USED)

3. **Whose boat did you fish from?** (IE, OWN BOAT, FRIEND'S BOAT, CHARTER BOAT....) IF CHARTER BOAT ONLY ON THAT TRIP, GO BACK TO Q1 FOR NEXT TRIP. IF CHARTER BOAT FISHING WAS DONE IN COMBINATION WITH PRIVATE BOAT GAMEFISHING IN SAME TRIP, RECORD PRIVATE BOAT GAMEFISHING ONLY.

4. **How many people came with you in the same vehicle on your trip?** (IF NONE, GO TO NEXT QUESTION). IF ONE OR MORE...**Did that person/these people also go on the boat with you? Were you joined by any others who didn't travel with you to <name of**

place/region where went fishing>? Did everybody on the boat participate in gamefishing? (RECORD)

5. **About how many hours did you gamefish that day/those days?**

6. **Approximately how many kilometres were travelled on the water that day/those days?**

7. **Other than gamefishing, did <u>you</u> do any <u>other</u> types of fishing, or any other water based activities** (IE, DIVING, SIGHT-SEEING) **whilst on the water?** (IF YES, PROBE AND RECORD TYPE/S AND AMOUNT OF TIME SPENT DOING IT/THEM)

8. **Did <u>you</u> target any particular species of gamefish?**

9. **Did <u>you</u> fish with lures, bait or fly?** (TICK EACH ONE)

10. **Were you fishing as part of a gamefishing competition?** IF YES, **Who was running the competition?** (IE, FISHING CLUB OR OTHER ORGANISATION)

11. **(And) did you (yourself) catch any gamefish (that day/those days)...?** (PROBE NUMBER CAUGHT AND KEPT BY SPECIES AND CAUGHT AND RELEASED BY SPECIES; BE CAREFUL WITH SHARED CATCHES/JOINT EFFORT).

12. **(And) what was caught by everybody gamefishing on the boat on that day/those days) ...?** (PROBE NUMBER CAUGHT AND KEPT BY SPECIES AND CAUGHT AND RELEASED BY SPECIES).

13. **Did you use your car**? IF NOT...**How did you get there?**

    13a. About how many kilometres were travelled by road on your trip?
    (FROM LEAVING HOUSE TO RETURNING)

    13b. How much did YOU spend on fuel, oil or other car related expenses on your trip?

    13c. Where was that expense/ these expenses made?

    13d. Thinking about why you went on your trip, what percentage of <repeat car related expenses made> do you think was due to going gamefishing? (MAY NEED TO EXPLAIN ATTRIBUTION – IE, GET THEM TO THINK ABOUT WHY THEY WENT ON THE TRIP TO (REGION/PLACE) AND EVALUATE THE IMPORTANCE OF GAMEFISHING AS A MOTIVATION TO GO ON THE TRIP AS OPPOSED TO OTHER ACTIVITIES THEY PARTICIPATED IN). IF STILL UNSURE, PROMPT WITH....**For example, you may have gone on your trip to do other things such**

as play golf or visit friends. IF OTHER WATER-BASED ACTIVITIES WERE INDICATED IN Q7, USE THESE AS EXAMPLES ALSO.

14. (IF LEFT AND RETURNED ON DIFFERENT DAYS)....**What type of accommodation did you stay in on you trip?** (MAY NEED TO SEPARATE OUT FOR LONGER TRIPS). **Where did you stay?** (MAY NEED TO SEPARATE OUT FOR LONGER TRIPS). **What did you (personally) spend on accommodation?** (IF ACCOMPANIED BY OTHERS) **About what was the total accommodation cost for everybody who travelled with you on your trip?** (IF UNSURE, ASK THEM FOR A BEST GUESS). **What percentage of this total accommodation cost do you think could be attributed to gamefishing?** (IF TOTAL ACCOMMODATION COST IS NOT GIVEN, APPORTION GAMEFISHING PERCENTAGE TO PERSONAL ACCOMMODATION COST, IF ANY).

15. **And did you (personally) buy anything to do with gamefishing on your trip? (Anything else?)** ...(ACTUAL PERSONAL EXPENDITURE, INCLUDING ON BEHALF OF OTHERS, THEN PROBE AS APPROPRIATE FOR ÓBVIOUS'ITEMS IE BAIT, BERLEY, TACKLE, ICE, COMPETITION FEES...BE CAREFUL NOT TO INCLUDE EXPENSES FOR OTHER TYPES OF FISHING) **How many people did your expenditure on <...each item..> pay for? Where did you purchase <..each item..>?**

16. **How much did you spend on boating expenses, such as fuel, oil or boat repairs on the trip? Do you know how much was spent by everybody on boating expenses on the trip?** (IF UNSURE, ASK FOR BEST GUESS. MAY NEED TO ITEMISE EXPENSES SEPERATELY). **Where were these purchases made? What percentage of these boating expenses do you think could be attributed to gamefishing (as opposed to other boating-related activities)?**

17. IF TRAVELLED MORE THAN 40KM FROM HOME (LOOK AT ADDRESS AND ITS PROXIMITY TO LAUNCHING PLACE: IF STILL UNSURE, ASK FOR DISTANCE FROM HOME)...**Did you (personally) buy any food or drink or any other personal expenses** (IE SUNSCREEN, CAMERA FILM ETC) **on your trip? Where was/were this/these item/s purchased? What percentage of these expenses do you think could be attributed to gamefishing?**

3. **AFTER LAST EVENT RECORDED**

(And) do you have any fishing trips planned for the next (TIME PERIOD)? (MAKE APPOINTMENT AS APPROPRIATE)

Appendix IV: Supplementary survey interview questions

CONFIDENTIALITY REMINDER

"Before I ask you the following questions I would like to remind you that any answers that you give will remain confidential and you will not be personally associated with your answers".

SATISFACTION / SEASON EVALUALTION

1(a). Compared to other seasons that you have gamefished in Tasmania, would you rate the size of fish caught over the 2007 gamefishing season as below average, average, or above average?

- **(b).** How about the number of fish available?
- **(c).** How about the range of fish species available to be caught?
- **(d).** How about the closeness of fish to boat launching areas

(e). Are you satisfied with the way in which the recreational gamefishery is managed in Tasmania? Why Not?

GAMEFISH PREFERENCE QUESTIONS

2. Of the gamefish species that you have caught in Tasmania, which one do you MOST prefer to catch?

3(a). Compared to other gamefish, how would you rate the fighting abilities of *<most preferred species>* on a scale from 1 to 5, with 1 being poor and 5 being excellent?

- **(b).** How about the eating quality?
- **(c).** Are there any other reasons why *<most preferred species>* are your most preferred species?

4. Of the gamefish species that you have caught in Tasmania, which one do you LEAST prefer to catch?

5(a). Compared to other gamefish, how would you rate the fighting abilities of *<least preferred species>* on a scale from 1 to 5, with 1 being poor and 5 being excellent?

- **(b).** How about the eating quality?
- **(c).** Are there any other reasons why *<least preferred species>* are your least preferred species?

CATCH AND RELEASE (SBT)

6. What do you normally do once you have caught and kept your bag limit of two bluefin tuna?

If they indicate that this has never happened, ask why/why not?

- *If they do not fish for bluefin tuna, go to Question 10 (SEALS)*
- *If the reason for this is that they have never been fortunate enough to catch their limit, Go to Question 7.*
- *If the reason for this is that they release all bluefin tuna they catch, proceed to Question 10 (SEALS).*

7. Do you ever release bluefin tuna before you have reached your bag limit?

If answered YES, Why?
If answered NO, go to Question 10 (SEALS)

8. Imagine you were fishing for bluefin tuna and you were confident of catching more than 2 bluefin tuna that day. Would you be more likely to release a 15kg fish or a 50kg fish? Why?

9. Imagine that you caught a bluefin tuna that you planned to release. However, after inspecting the condition of the fish you thought that it had a less than average chance of surviving. Would you be more likely to keep that fish? If NO, why not?

SEALS

10. Did you hook any species of tuna this season that were lost to seals before being landed?

If YES, what species of tuna? How many?

11. Do you/would you include seal damaged fish, or parts of fish landed as part of your daily bag limit?

12. When seals are around the boat, are you less likely to release fish?

13. Do you avoid fishing in areas where you know there are more seals than other areas?

14. Do you use a heavier line class when you know that seals are around?

15. Have you ever used a decoy such as a previously caught fish to distract seals when attempting to land a fish onto the boat?

16. Are there any other ways in which seals have influenced the way in which you fish for gamefish?

SUSTAINABILITY

17. Compared to other gamefishers, would you consider your understanding of the sustainability of gamefish that are caught in Tasmania to be poor, adequate, good or excellent?

18. Are you concerned about the state of bluefin tuna stocks?

If YES, continue to Question 19.
If NO, why not? Go to question 20.

19. Has your concern about bluefin stocks affected the way in which you fish for bluefin tuna?

If Yes, How?

20. To conserve gamefish for the future, do you consider that it is more worthwhile to release smaller fish, larger fish or both equally? Why?

21. At the moment, there is not a lot of information about the survival of tuna and sharks after being released by anglers. However, if new studies confirmed that only a small percentage of tuna and sharks survived after being released by anglers.....

- **(a).** Would you be more likely to use a heavier line class or change other equipment to increase the chances of fish surviving?
- **(b).** Would it change the way in which you play a fish that you plan to release? If Yes, how?
- **(c).** Would it change the way in which you handle a fish that you plan to release? If Yes, How?
- **(d).** Would you be more likely to keep a higher number of fish instead of releasing them?
- **(e).** Would you be more likely to stop fishing for your target species after you have caught your bag limit?
- **(f).** Is there any other way in which this type of information would change the way in which you fish for tuna and sharks?

CONTINGENT VALUATION

We ask this next question so we can better understand the value of the gamefishery to anglers. This type of question gives us an insight into anglers attitudes towards gamefishing and the importance that Tasmanian gamefishers put on their sport. Gamefishing may be worth more to anglers than what they pay to do it, and you will soon be asked to put a dollar figure on the value that you place on gamefishing. When I ask you, please consider your answer carefully and within the confines of your income.

22. Based on the information you have given us during this survey, your trip expenses for this season were approximately $<*insert*>. Now, imagine that your trip expenses increased to the point where it cost you an extra $500 a season to go gamefishing as often as you did this season. Think about the benefits you gain from gamefishing, and keep in mind your level of income and other financial responsibilities. Would you be prepared to pay the extra $500 in fishing related expenses to go gamefishing as often as you did this season?

<u>If answered YES</u>, increase the bid ($1000, $2000, $3000, $4000, $5000) until the respondent says NO. Therefore, you will end up with a range ie an upper and lower bound figure. If the respondent still says YES at $5000, ask "What would be the most you would pay over and above your current annual expenses before deciding not to go gamefishing"?

<u>If answered NO</u>, halve the bid ($250, $150, $75.) until the respondent says YES. Again, you will end up with an upper and lower bound figure. If the respondent still says "NO" at $40, ask "What would be the most you would pay over and above your current annual expenses before deciding not to go gamefishing"? "*If the respondent answers $0, ask* Why? (*See if answer matches any of the three alternatives below*)

a) they object to these type of questions
b) they feel that they currently pay enough and are not prepared to pay more than they currently do to continue gamefishing
c) they cannot afford to pay any more than they do now

Appendix V: Distribution and ranking of responses to motivational items by private boat and charter boat fishers

Motivational Items	Catch or non-catch related	Private Boat Fishers					Charter Boat Fishers				
		Importance Ranking[a]			Item Mean Importance	Rank	Importance Ranking[a]			Item Mean Importance	Rank
		1 (%)	2 (%)	3 (%)			1 (%)	3 (%)	3 (%)		
For relaxation	NCR	86.0	11.3	2.7	4.23	1	79.3	19.3	1.4	4.03	1
To be outdoors	NCR	73.4	17.9	8.7	3.88	2	73.1	18.6	8.3	3.88	3
Weather conditions	NCR	66.7	22.9	10.4	3.81	3	71.0	24.8	4.1	3.49	10
To be with friends	NCR	69.2	22.9	7.9	3.80	4	65.5	28.3	6.2	3.75	4
To be close to the water	NCR	67.6	21.2	11.2	3.79	5	59.3	27.6	13.1	3.74	5
For the experience of catching fish	CR	67.2	23.7	9.1	3.78	6	59.3	29.0	11.7	3.64	7
For family recreation	NCR	65.6	22.4	12.0	3.69	7	63.4	22.1	14.5	3.05	15
To experience unpolluted natural surroundings	NCR	62.1	20.9	17.0	3.67	8	63.4	24.1	12.4	3.89	2
To get away from the regular routine	NCR	60.7	21.8	17.5	3.60	9	60.0	27.6	12.4	3.63	8
To obtain fish to eat	CR	55.8	27.1	17.1	3.56	10	49.0	32.4	18.6	3.08	14
To experience adventure and excitement	NCR	51.6	29.8	18.7	3.43	11	49.0	29.7	21.4	3.69	6
To experience new and different things	NCR	50.0	31.1	18.9	3.38	12	51.7	23.4	24.8	3.57	9
To get away from the demands of other people	NCR	48.8	22.6	28.6	3.28	13	49.0	26.2	24.8	3.42	11
To develop my fishing skills	CR	42.9	31.0	26.2	3.20	14	31.3	41.7	27.1	3.42	12
For challenge or sport	CR	46.2	27.5	26.3	3.19	15	39.3	33.8	26.9	3.36	13
Fish availability	CR	24.3	32.0	43.7	2.61	16	22.6	32.9	44.5	2.5	18
To catch a trophy fish	CR	22.1	26.9	51.0	2.54	17	23.4	29.0	47.6	2.60	17
To test my fishing gear	CR	24.1	27.7	48.2	2.52	18	20.7	27.6	51.7	2.63	16
To fish where it is not difficult to catch fish	CR	19.0	30.0	51.0	2.46	19	13.8	30.3	55.9	2.35	19
To participate in competition	CR	10.4	15.6	74.0	1.83	20	4.1	17.2	78.6	1.67	20

Mean scores for all items were based on responses to the following response categories; 5 = Extremely Important, 4 = Important, 3 = Moderately Important, 2 = Slightly Important, 1 = Not at all Important

[a] 1 = percentage of responses to "extremely important" and "important". 2 = percentage of responses to "moderately important". 3 = responses to "slightly important" and "not at all important"

Appendix VI: Distribution of responses to consumptive orientation items by private boat and charter boat fishers

	Private boat fishers (n = 259)				Charter boat fishers (n = 146)					
	Mean (±*SD*)	A (%)	N (%)	D (%)	Mean (+/- *SD*)	A (%)	N (%)	D (%)	t	p (2-tailed)
Attitudes To Catching Fish										
A fishing trip can be successful even if no fish are caught[a]	3.88 (1.00)	77.2	10.1	12	3.70 (1.09)	68.8	9.0	20.8	-1.68	0.093
I'm just as happy if I don't catch a fish	2.89 (1.07)	39.8	29.7	30.1	2.99 (1.10)	34.7	27.8	36.8	-0.888	0.375
If I thought I would not catch a fish I would not go fishing	2.83 (1.26)	35.5	14.7	50.2	2.64 (1.25)	27.8	18.8	50.1	1.455	0.147
I'm not satisfied unless I catch at least something	2.88 (1.07)	31.3	26.3	42.9	2.74 (1.17)	37.5	22.2	38.9	-1.106	0.269
Attitudes To Catching Numbers of Fish										
The more fish I catch the happier I am	2.80 (1.06)	27.1	33.6	39.4	3.16 (1.09)	41.7	28.5	30.6	-3.24	0.001
A successful fishing trip is one in which many fish are caught	2.71 (1.02)	28.6	31.3	45.2	2.95 (1.16)	34.1	25.0	40.1	-2.12	0.034
Attitude to Catching Large/Trophy Fish										
I would rather catch 1 or 2 big fish than 10 smaller fish	3.72 (0.98)	61.4	27.8	11.2	3.76 (1.10)	63.9	21.5	13.2	0.507	0.612
The bigger the fish I catch the better the fishing trip	3.10 (1.04)	36.3	33.6	30.5	3.41 (1.04)	50.0	26.4	22.9	-2.805	0.005
I'm happiest when I catch a challenging fish	4.02 (0.83)	77.6	17.4	5.4	4.30 (0.31)	91.7	6.9	1.4	-3.371	0.001
I like to fish where I know I may catch a trophy fish[a]	2.97 (1.09)	33.6	32.4	34.0	3.08 (1.24)	38.6	22.9	36.1	0.888	0.375
Attitude to Retaining Fish										
I'm just as happy if I release the fish I catch	3.30 (1.03)	46.3	30.9	22.8	3.66 (0.87)	60.4	26.4	11.3	3.552	0.000
I want to keep all the fish I catch[a]	2.25 (0.98)	13.1	17.4	69.1	1.92 (0.85)	3.5	18.1	77.1	3.510	0.001
Additional Item										
It doesn't matter to me what type of fish I catch	3.00 (1.04)	37.5	27.0	34.4	3.25 (1.01)	47.9	18.1	32.6	-2.293	0.022

Mean scores are based on levels of agreement to attitudinal statements (items) pertaining to each category. Attitudinal statements were coded as follows: 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree

A=Agree, N=Neutral, D=Disagree

a Both t and p values are based on output for "unequal variances not assumed" due to violation of Levene's assumption of homogeneity of variance

Appendix VII: Distribution of responses to nine management proposals by private boat and charter boat fishers

	Private boat fishers (n = 259)				**Charter boat fishers** (n = 146)					
	Mean (±*SD*)	A (%)	N (%)	D (%)	Mean (+/- *SD*)	A (%)	N (%)	D (%)	t	p (2-tailed)
The encouragement of catch and release fishing	3.65 (1.05)	54.6	29.2	15.4	3.94 (1.01)	67.1	26.0	6.9	2.637	0.008
A personal bag limit of 5 albacore tuna[a]	3.61 (1.14)	71.9	9.5	18.2	3.43 (1.27)	58.2	15.8	26.0	-1.468	0.143
Gamefish possession limits for boats	3.60 (1.08)	66.8	16.6	16.6	3.94 (1.06)	74.0	13.7	12.3	3.062	0.002
The encouragement of tag and release fishing	3.54 (1.04)	58.1	21.3	19.8	3.93 (0.99)	66.4	17.1	16.4	3.702	0.000
A personal combined bag limit of 1 MS or BS	3.49 (1.12)	60.1	20.2	19.4	3.82 (1.23)	75.3	8.2	16.4	2.749	0.006
A minimum size limit for albacore tuna	3.49 (1.10)	60.1	24.9	13.8	3.71 (1.14)	71.9	19.2	8.9	1.899	0.056
Striped marlin to be catch and release only[a]	3.18 (1.24)	44.7	22.9	31.6	3.32 (1.37)	50.7	17.1	32.2	1.027	0.305
A personal combined bag limit of 1 SBT or YT	3.08 (1.26)	47.4	14.2	37.6	3.39 (1.34)	58.9	8.2	32.9	2.352	0.019
Southern bluefin tuna to be catch and release only[a]	2.22 (1.01)	10.3	22.9	65.6	2.60 (1.25)	22.6	26.7	50.7	3.358	0.001

Mean scores are based on levels of agreement to attitudinal statements (items) pertaining to each category. Attitudinal statements were coded as follows: 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree

A=Agree, N=Neutral, D=Disagree

[a] Both t and p values are based on output for "unequal variances not assumed" due to violation of Levene's assumption of homogeneity of variance